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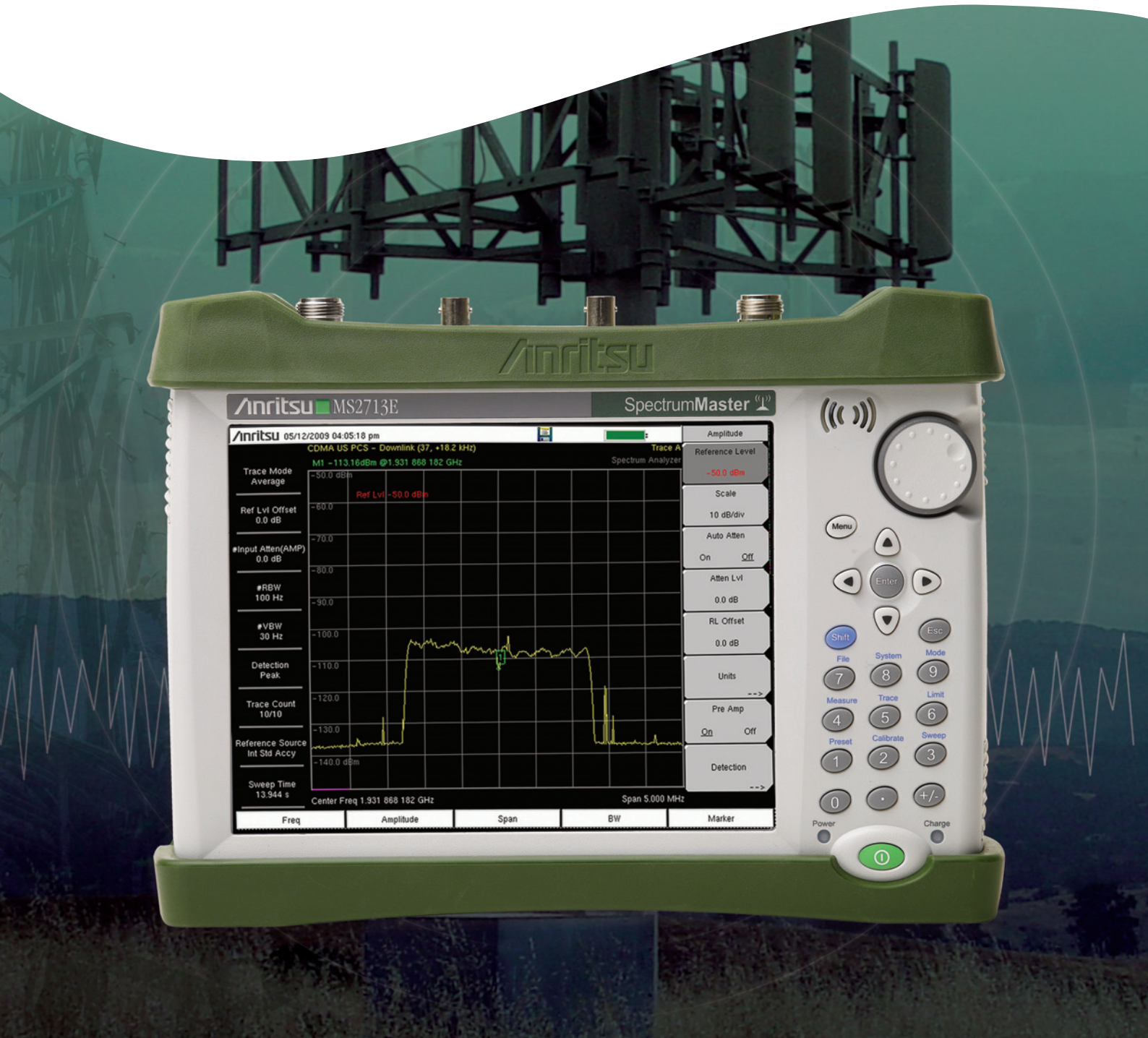
Product Brochure

Spectrum Master™

Compact Handheld Spectrum Analyzer

MS2712E
9 kHz to 4 GHz

MS2713E
9 kHz to 6 GHz



Anritsu Introduces its Next Generation Compact Spectrum Analyzer

The wireless communications market is rapidly growing as the telecommunications and defense sectors continue to evolve. Whether you are installing, troubleshooting, or solving problems for military communications facilities, public safety providers, or wireless service providers, Anritsu has a solution.

Anritsu's new Spectrum Master has been designed for technicians, installers, field radio frequency (RF) engineers, and contractors who struggle with both keeping track of the growing number of interfering signals and assessing signal quality on a wide range of increasingly complex signals. Easy-to-use, integrated and high performing, the Spectrum Master helps users address those challenges and more. Its feature-rich and compact design helps users comply to regulatory requirements, manage and maximize efficiency, improve system up-time, and increase revenue – all in a rugged and field-proven device designed to withstand even the most punishing conditions.

This next generation of Anritsu's best-in-class Spectrum Master series is ideal for spectrum monitoring, interference analysis, RF and microwave measurements, field strength measurements, transmitter spectrum analysis, electromagnetic field strength, signal strength mapping, and overall field analysis of cellular 2G/3G/4G, land mobile radio, Wi-Fi, and broadcast signals.

Designed For Field Use

The Spectrum Master was designed specifically for field environments. Weighing less than 3.45 kg, it is small compact and easy to carry. Its field replaceable Li-Ion battery typically lasts for more than 3 hours, and a new bright 8.4-inch color display provides visibility even in broad daylight. With an operating temperature range from -10 °C to 55 °C, a rugged case and splash proof design, the Spectrum Master works in the most extreme weather conditions with guaranteed performance anywhere and anytime.

Integrated Solution

The Spectrum Master is a multifunctional instrument that eliminates the need for you to carry and learn multiple instruments. It can be configured to include a broad range of parameters, including a 4 GHz or 6 GHz spectrum analyzer, an interference analyzer with signal mapping, coverage mapping, Tracking Generator, channel scanner, power meter, high accuracy power meter, AM/FM/PM Analyzer, and GPS receiver for time/location stamping and accuracy enhancements.

In addition, the Spectrum Master can be equipped with a GSM/EDGE Analyzer, W-CDMA/HSPA+ Analyzer, TD-SCDMA Analyzer, CDMA Analyzer, EV-DO Analyzer, Fixed and Mobile WiMAX Analyzer, LTE Analyzer, ISDB-T Analyzer, thus eliminating the need to carry multiple instruments to the field.

Easy-To-Use

The new Spectrum Master leverages the user interface from Anritsu's popular MS2721B analyzer, giving users intuitive spectrum analyzer menus. A touchscreen keypad combination provides you with an intuitive menu-driven interface designed to give a familiar menu structure with quick access to popular measurements.

Key Facts

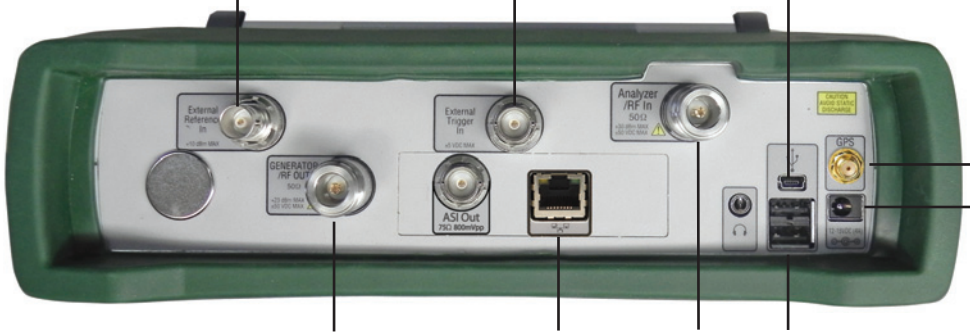
- 9 kHz to 4 GHz (MS2712E)
- 9 kHz to 6 GHz (MS2713E)
- One-button measurements: ACPR, Channel Power, Field Strength, Occupied BW, AM/FM/SSB Demod
- Interference Analyzer: Spectrogram, Signal Strength, RSSI, Signal ID, Interference Mapping
- Indoor and Outdoor Coverage Mapping
- 3GPP Signal Analyzers: LTE, GSM/EDGE, W-CDMA/HSPA+, TD-SCDMA/HSPA+
- 3GPP2 Signal Analyzers: cdmaONE/CDMA2000 1X, CDMA2000 1xEV-DO
- IEEE 802.16 Signal Analyzers: Fixed WiMAX, Mobile WiMAX
- ISDB-T Signal Analyzer
- DANL: > -162 dBm in 1 Hz RBW
- Dynamic range: > 102 dB in 1 Hz RBW
- +33 dBm TOI typical @ 6 GHz
- < Phase Noise: -100 dBc/Hz @ 10 kHz at 1 GHz
- Frequency accuracy: < ± 50 ppb with GPS on
- Detection methods: Peak, RMS, Negative, Sample, Quasi-peak
- Save-on-event: Automatically saves a sweep when crossing a limit line or at the end of the sweep.
- Gated sweep: View pulsed or burst signals only when they are on, or off.
- Three hours of battery life
- Touch-screen display
- USB and Optional Ethernet for data transfer and instrument control
- Line Sweep Tools
- 8.4-inch daylight viewable touchscreen display
- Lightweight: < 3.45 kg

Integrated Measurement Capabilities

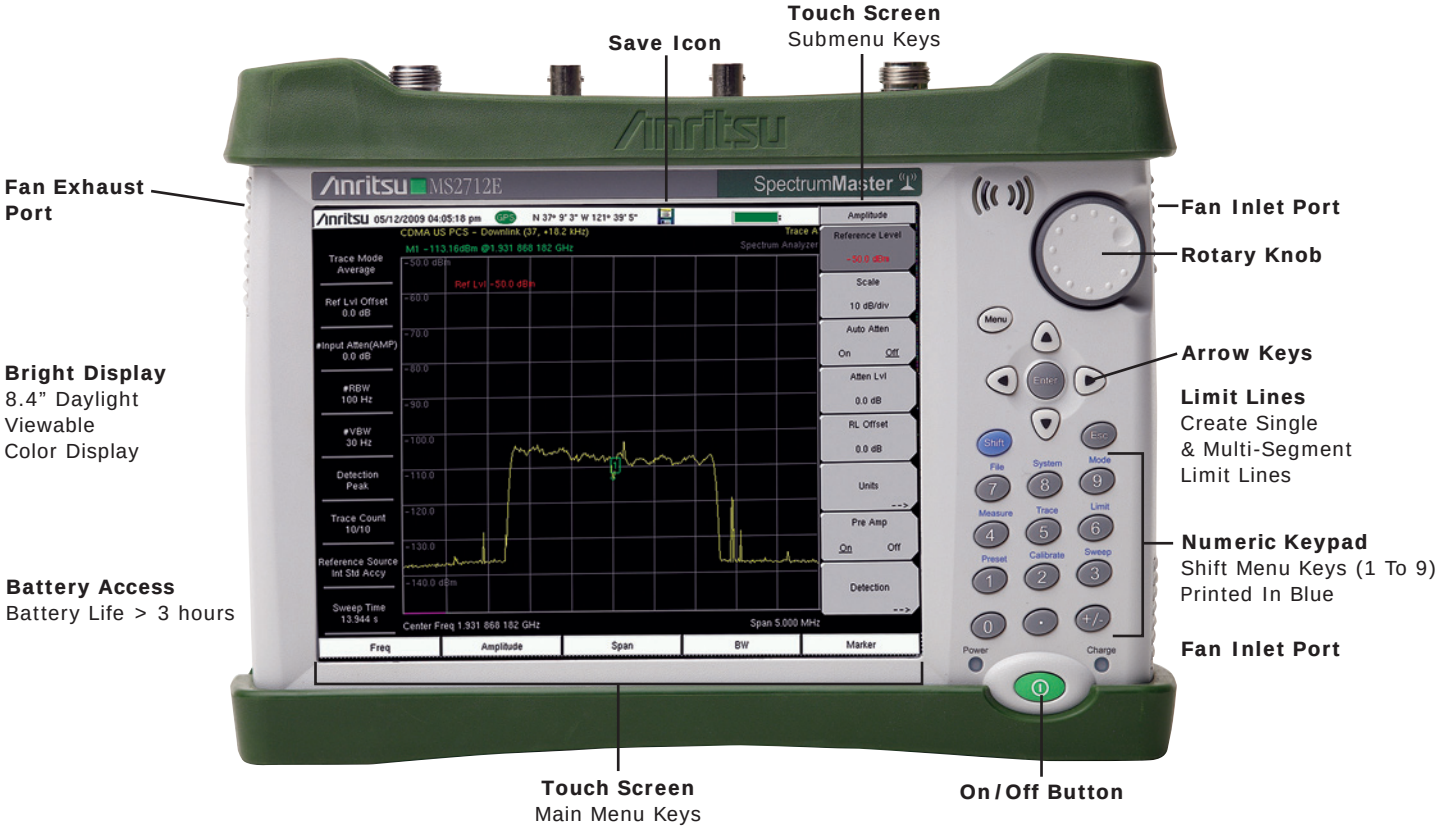
Configuration Overview

FUNCTION	DESCRIPTION
Spectrum Analyzer, 9 kHz to 4/6 GHz	Locates and identifies various signals over a wide frequency range. Detects signals as low as -152 dBm with phase noise better than -100 dBc/Hz.
Interference Analyzer (Option 25)	Includes everything you need to monitor, identify, and locate interference using the spectrogram display, RSSI, Signal ID, signal strength meter, and interference mapping.
Coverage Mapping (Option 431)	Provides indoor and outdoor mapping capabilities of RSSI, and ACPR measurement levels.
GPS Receiver (Option 31)	Provides location and UTC time information. Also improves the accuracy of the reference oscillator.
Tracking Generator (Option 20)	Features high dynamic range with power steps ranging from -50 dBm to 0 dBm in 0.1 dB steps.
Bias Tee (Option 10)	Possesses a built-in 32 V bias tee that can be turned on as needed and applied to the RF In port.
High Accuracy Power Meter (Option 19)	Connects high accuracy 4, 6, 8, 18, and 26 GHz USB power sensors with better than ± 0.16 dB accuracy.
Power Meter (Option 29)	Makes channelized transmitter power measurements.
Channel Scanner (Option 27)	Measures the power of multiple transmitted signals. Scans up to 1200 channels using Script Master.
Gated Sweep (Option 90)	Views pulsed or burst signals such as WiMAX, GSM, and TD-SCDMA only when they are on.
AM/FM/PM Analyzer (Option 509)	Analyzes AM/FM/PM signals and measures FM/PM deviation, AM depth, SINAD, Total Harmonic Distortion and much more.
PIM Analyzer (Option 419)	The PIM Analyzer measures the 3rd, 5th, or 7th order intermodulation products in the receive band of two high power tones generated by the 40 Watt PIM Master.
10 MHz Bandwidth Demod (Option 9)	The 10 MHz BW demod option enables users to turn the Spectrum Master in to a Signal Analyzer.
GSM/EDGE Measurements (Option 40, 41)	RF and Demod Measurements enables end users to increase data rate and capacity by ensuring good signal quality.
W-CDMA/HSPA+ Measurements (Option 44, 45, 65, 35)	Uses Spectrum Master's RF, Demod, and OTA Measurements to verify frequency error, multipath signals, EVM and much more.
LTE (Option 541, 542, 546)	Spectrum Master's LTE Measurements enables users to make RF, Demod, and OTA Measurements. Verify ACLR, Cell ID, Frequency Error, EVM, and much more.
TD-SCDMA/HSPA+ Measurements (Option 60, 61, 38)	The TD-SCDMA/HSPA+ analyzer includes RF, Demod, and OTA measurements and the ability to measure EVM and Peak CDE. It also includes an OTA Tau scanner.
cdmaOne/CDMA2000 1X (Option 42, 43, 33)	RF, Demodulation, and OTA Measurements. Measures EVM, Noise floor, ACPR and much more.
Fixed and Mobile WiMAX (Option 46, 47, 66, 67, 37)	RF Demod, and OTA Measurements verify Cell ID, Sector ID, Preamble, EVM, RCE, and much more.
ISDB-T (Option 30, 32)	Makes RF and Demod Measurements to verify Spectrum Mask and MER. Ensures digital TV transmitters are configured according to license agreements.
Ethernet Connectivity (Option 411)	Provides the ability to operate automated testing from remote PC, or conversely, to upload data from field test to the PC. Remote access control is also provided through Master Software Tools.

Designed for the Field



All connectors are conveniently located on the top panel, leaving the sides clear for handheld use.



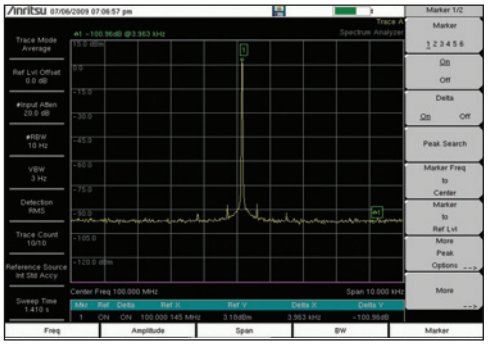
Convenient Soft Case and Tilt Bail

Tilt Bails are integrated into the case and soft case for better screen viewing.

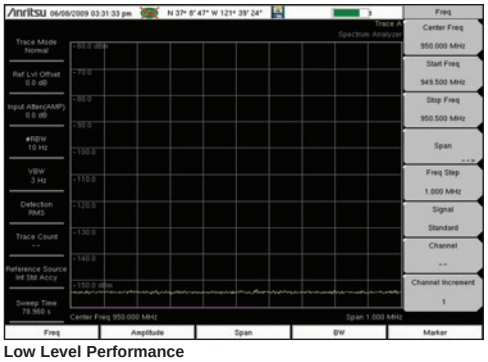
Best Performance in its Class

Anritsu's MS2712E and MS2713E Spectrum Master spectrum analyzers provide users with high-performance for field environments and for applications requiring mobility. There is no other spectrum analyzer in this class that can deliver the same performance.

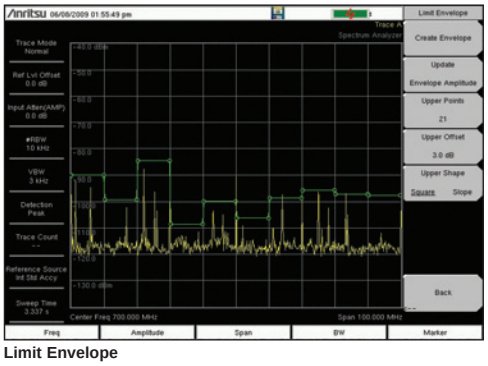
The combination of its performance and compact design makes it ideal for a broad range of activities, including spectrum monitoring, interference analysis, field strength measurements, transmitter spectrum analysis, electromagnetic field strength, signal strength mapping, and overall field analysis of cellular 2G/3G/4G, land mobile radio, Wi-Fi, and broadcast signals.



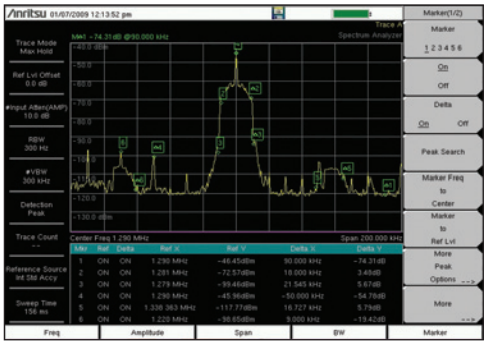
Dynamic Range Performance



Low Level Performance



Limit Envelope



Comprehensive Marker Menu

High Performance

The dynamic range is better than 102 dB in 1 Hz, enabling measurement of very small signals in the presence of much larger signals. The picture demonstrates the dynamic range in the Spectrum Master

Displayed Average Noise Level

Spectrum Master delivers impressive and best-in-class DANL performance. With the built-in pre-amp, better than 102 dBm DANL can typically be realized in 1 Hz RBW. This low-level performance capability is essential when looking for low-level interference signals.

GPS-Assisted Frequency Accuracy

With GPS Option 0031 the frequency accuracy is < 50 ppb. This additional accuracy is important when characterizing 3GPP signals using counted frequency markers. Also all measurements can be GPS tagged for exporting to maps.

Simple but Powerful for Field Use

Convenience is a must in the field. This is why the Spectrum Master is equipped with features that will enhance productivity in the field.

The Spectrum Master is equipped with limit lines for all user levels. You can create single limit lines and segmented limit lines in one step using the one-button limit envelope feature.

The Spectrum Master automatically sets the fastest sweep possible while still ensuring accurate measurements. This allows users to rely on the instrument to optimize accuracy and consistency.

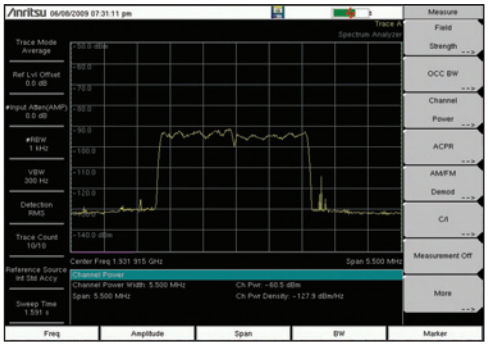
Auto Attenuation ties the input attenuation to the reference level eliminating the need for the user to determine how much attenuation is needed.

Six regular and six delta markers can be displayed with a marker table that can be turned on as needed. The capability to measure noise level in terms of dBm/Hz or dBµV/Hz is a standard feature of the Spectrum Master.

Master Transmitter Testing

Smart Measurements for Transmitter Systems

Commonly needed transmitter measurements are built in and can be accessed easily. These include field strength, occupied bandwidth, channel power, adjacent channel power ratio (ACPR), and emission mask.



Occupied Bandwidth

Occupied Bandwidth

This measurement determines the amount of spectrum used by a modulated signal. The Spectrum Master allows you to choose between two different methods of determining bandwidth: the percent-of-power method or the “x” dB down method.

Adjacent Channel Power Ratio

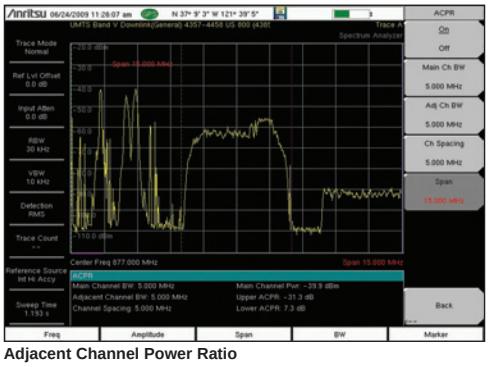
Adjacent Channel Power Ratio is a common transmitter measurement. High ACPR will create interference for neighboring carriers. This measurement can be used to replace the traditional two-tone Intermodulation Distortion (IMD) test for system non-linear behavior.

Field Strength Measurements

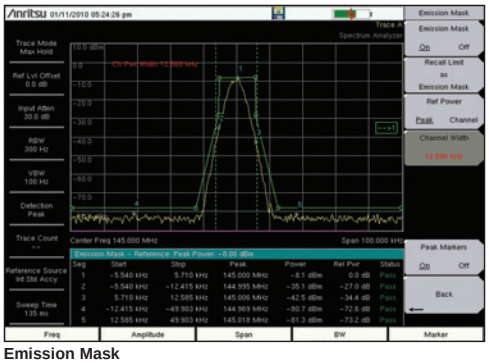
The Spectrum Master can determine the effects of electromagnetic fields caused by transmitter systems. Specific antenna factors of the connected antenna are automatically taken into account, and field strength is displayed directly in dBµV/m. The Spectrum Master also supports a wide range of directional antennas. If you are using a different antenna, Master Software Tools can be used to edit the antenna list and upload the custom antenna list to the instrument to accurately measure the maximum field strength.

Emission Mask

The emission mask is a segmented upper limit line that will display frequency range, peak power and frequency, relative power and pass/fail status for each segment of the mask. The emission mask must have at least two segments. Emission mask adjusts to the peak power value of transmitted signal level per government emission mask requirements.



Adjacent Channel Power Ratio

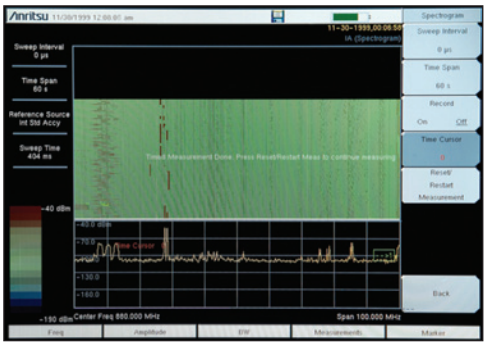


Emission Mask

Master the Location of Interference

As the wireless industry continues to expand, more diverse uses for the radio spectrum emerge, and the number of signals that may potentially cause interference is constantly increasing.

Compounding the problem are the many sources that can generate interference, including intentional radiators, un-intentional radiators, and self interference. Interference causes Carrier-to-Interference degradation robbing the network of capacity. The goal of these measurements is to resolve interference issues as quickly as possible.



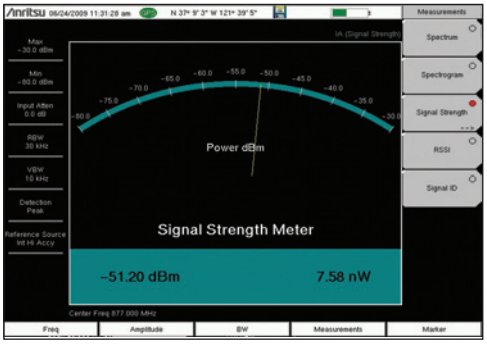
Spectrogram Display

Interference Analysis (Option 25)

The interference analyzer option provides you with a spectrogram display, RSSI, signal strength meter, signal ID, and signal mapping capabilities. Spectrum Master's integrated spectrum analyzer can detect signals as low as –152 dBm.

Spectrogram Display

This option provides you with a three-dimensional display of frequency, power, and time of the spectrum activity to identify intermittent interference and track signal levels over time. The dual display screen allows for easy viewing of both the spectrum and 3D display. The Spectrum Master allows you to save a history of data up to one week.



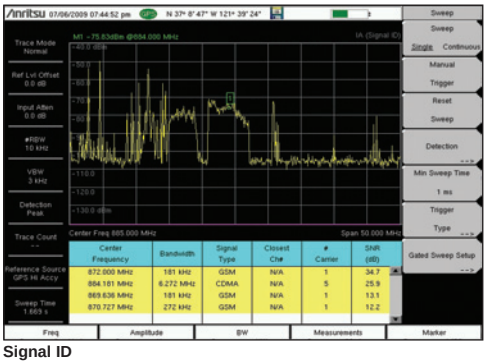
Signal Strength Meter

Received Single Strength Indicator (RSSI)

You can use the Spectrum Master's RSSI measurement to observe the signal strength of a single frequency over time, and collect data for up to one week.

Signal Strength Meter

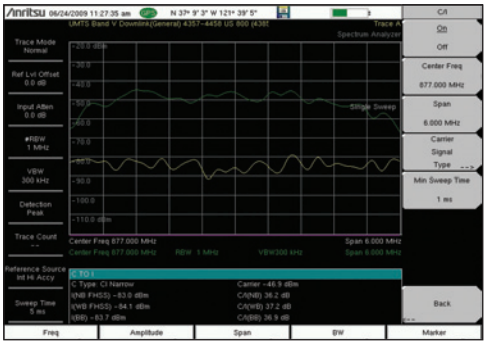
The Spectrum Master's signal strength meter can locate an interfering signal by using a directional antenna and measuring the signal strength. It displays power in Watts or dBm, in the graphical analog meter display and by an audible beep proportional to its strength.



Signal ID

Signal ID

Spectrum Master's signal ID feature in the interference analyzer can help you quickly identify the type of the interfering signal. You can configure this measurement to identify all signals in the selected band or to simply monitor one single interfering frequency. The Spectrum Master then displays results that include center frequency, signal bandwidth, and signal type (FM, GSM/EDGE, W-CDMA/HSPA+, CDMA/EV-DO, Wi-Fi.



Carrier-to-Interference (C/I)

Carrier-To-Interference Measurement

Spectrum Master's carrier-to-interference measurement capability makes it simple for you to determine if the level of interference will affect users in the intended service area.

AM/FM/SSB Demodulation

A built-in demodulator for AM, narrowband FM, wideband FM and single sideband allows you to easily identify the interfering signal.

Pin Point Location of Interfering Signal with Interference Mapping

Interference Mapping with Google Earth™

Interference Mapping

The Interference Mapping measurement eliminates the need to use printed maps and draw lines to triangulate the interfering signal.

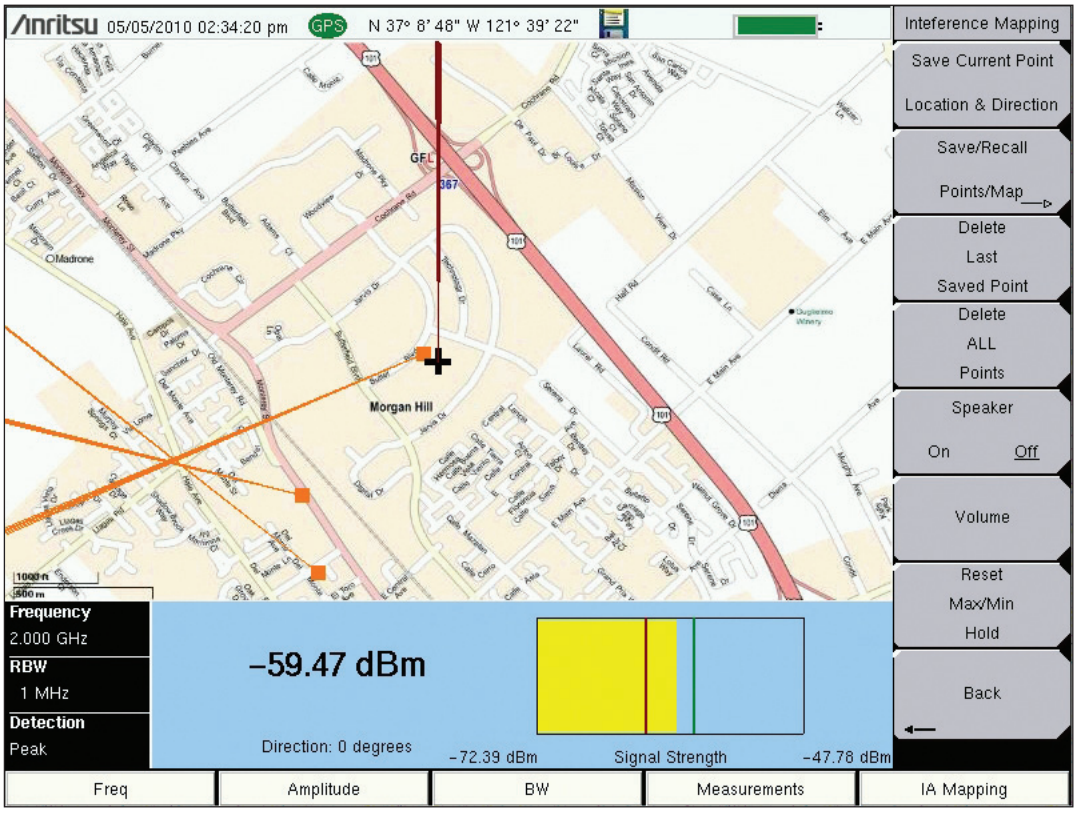
Using Map Master, it is easy to convert maps and make them compatible with the Spectrum Master. With a valid GPS signal, the instrument identifies the user location on the map. Using one of the recommended Anritsu Yagi antennas, you can identify the direction of the interfering signal and input the angle information with the rotary knob. With two or more lines from different locations, it is possible to obtain an estimate location of the interfering signal. The Interference Mapping can be done directly on the Spectrum Master. Files can also be saved as kml and opened with Google Earth™.

Directional Antennas

Anritsu offers more than eight different directional antennas covering a wide range of frequency bands including: 822 to 900 MHz, 885 to 975 MHz, 1710 to 1880 MHz, 1850 to 1990 MHz, 2400 to 2500 MHz, 1920 to 2170 MHz, 500 to 3000 MHz, and 600 to 21000 MHz.

GPS Antenna

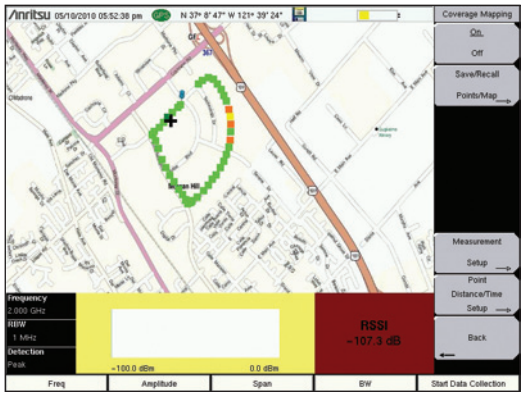
The 2000-1528-R GPS antenna and Option 31 are required for the interference mapping and coverage mapping measurements.



On Screen Interference Mapping

Indoor and Outdoor Coverage Mapping Solutions (Option 0431)

There is a growing demand for coverage mapping solutions. Anritsu's Coverage Mapping measurements option provides wireless service providers, public safety users, land mobile ratio operators, and government officials with indoor and outdoor mapping capabilities

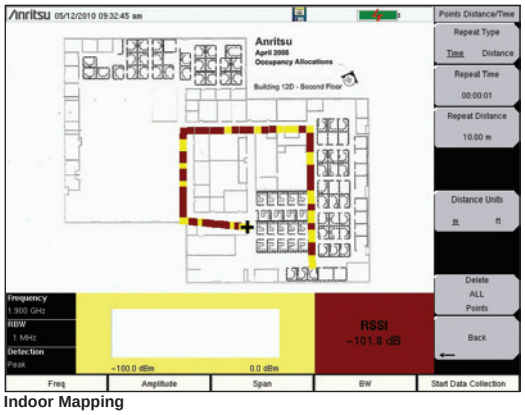


Outdoor Mapping

Outdoor Mapping

With a GPS antenna connected to the instrument and a valid GPS signal, the instrument monitors RSSI and ACPR levels automatically. Using a map created with Map Master, the instrument displays maps, the location of the measurement, and a special color code for the power level. The refresh rate can be set up in time (1 sec, minimum) or distance.

The overall amplitude accuracy coupled with the GPS update rate ensures accurate and reliable mapping results



Indoor Mapping

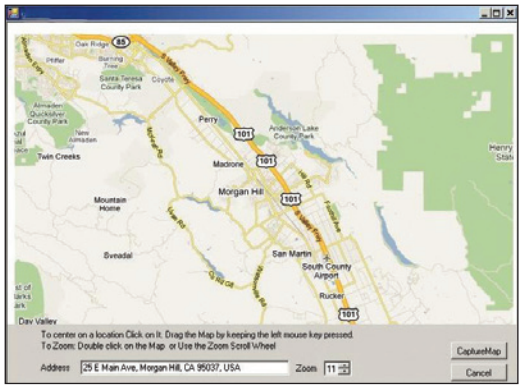
Indoor Mapping

When there is no GPS signal valid, the Spectrum Master uses a start-walk-stop approach to record RSSI and ACPR levels. You can set the update rate, start location, and end location and the interpolated points will be displayed on the map.

Saved KML File

Export KML Files

Save files as KML or JPEG. Open kml files with Google Earth™.
When opening up a pin in Google Earth, center frequency, detection method, measurement type, and RBW are shown on screen.



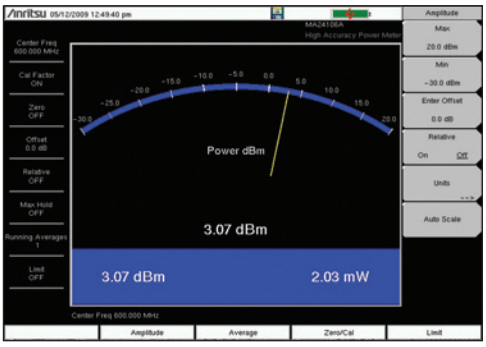
Create maps with Map Master

Map Master

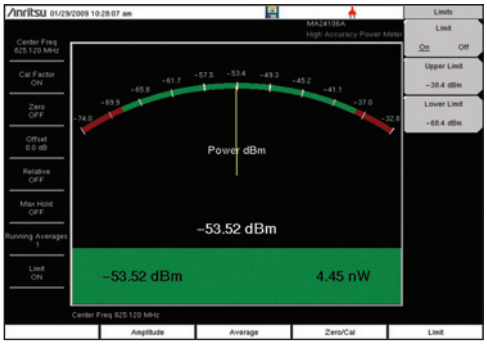
The Map Master program creates maps compatible with the Spectrum Master. Maps are created by typing in the address or by converting existing JPEG, TIFF, BMP, GIF, and PNG files to MAP files. Utilizing the built-in zoom in and zoom out features, it is easy to create maps of the desired location and transfer to the instrument with a USB flash card. Map Master also includes a GPS editor for inputting latitude and longitude information of maps from different formats.

Power Measurements for a Wide Range of Applications

The Spectrum Master supports many different power measurements, including the channel scanner, high accuracy power meter, internal power meter, and channel power measurement.

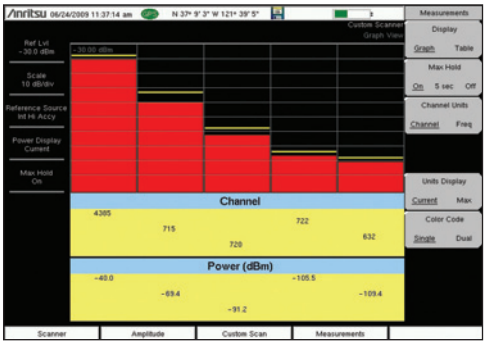


Power Meter



High Accuracy Power Meter

High Accuracy Power Sensors



Channel Scanner

Channel Power

Use Spectrum Master's channel power measurement to determine the power and power density of a transmission channel. Using the built-in signal standard list, you can measure the channel power of a wide range of signals.

Power Meter (Option 29)

Spectrum Master's internal power meter provides power measurements without any additional tools and is ideal for making channelized power measurements. You can display the results in both dBm and Watts. This option is easy to use and requires limited setup entries.

High Accuracy Power Meter (Option 19)

Anritsu's high accuracy power meter option enables you to make high accuracy RMS measurements. This capability is perfect for measuring both CW and digitally modulated signals such as CDMA/EV-DO, GSM/EDGE, and W-CDMA/HSPA+. You can select from a wide range of USB sensors delivering better than ± 0.16 dB accuracy. An additional benefit of using the USB connection is that a separate DC supply (or battery) is not needed because the necessary power is supplied by the USB port.

- PSN50 High Accuracy RF Power Sensor, 50 MHz to 6 GHz, –30 dBm to +20 dBm, True-RMS
- MA24104A Inline High Power Sensor, 600 MHz to 4 GHz, +3 dBm to +51.76 dBm, True-RMS
- MA24105A Inline Peak Power Sensor, 350 MHz to 4 GHz, +3 dBm to +51.76 dBm, True-RMS
- MA24106A High Accuracy RF Power Sensor, 50 MHz to 6 GHz, –40 dBm to +23 dBm, True-RMS
- MA24108A Microwave USB Power Sensor, 10 MHz to 8 GHz, –40 dBm to +20 dBm, True-RMS
- MA24118A, Microwave USB Power Sensor, 10 MHz to 18 GHz, –40 dBm to +20 dBm, True-RMS
- MA24126A, Microwave USB Power Sensor, 10 MHz to 26 GHz, –40 dBm to +20 dBm, True-RMS

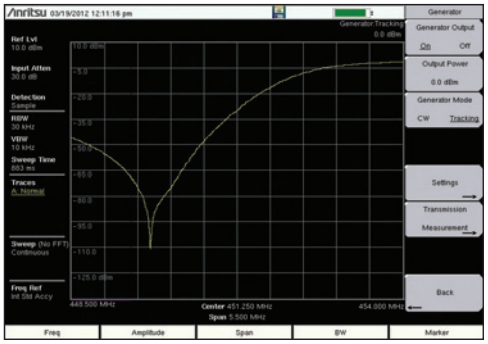
PC Power Meter

These power sensors can be used with a PC running Microsoft Windows® via USB. They come with PowerXpert™ application, a data analysis, and control software. The application has abundant features, such as data logging, power versus time graph, big numerical display, and many more, that enable quick and accurate measurements.

Channel Scanner (Option 27)

The channel scanner option measures the power of multiple transmitted signals, making it very useful for simultaneously measuring channel power of up to 20 channels in GSM, TDMA, CDMA, W-CDMA, HSDPA, and public safety networks. You can select the frequencies or the scanned data to be displayed, either by frequencies or the channel number. And in the custom setup menu, each channel can be custom built with different frequency bandwidth, or with channels from different signal standards. With Script Master, scans can be automated for up to 1200 channels.

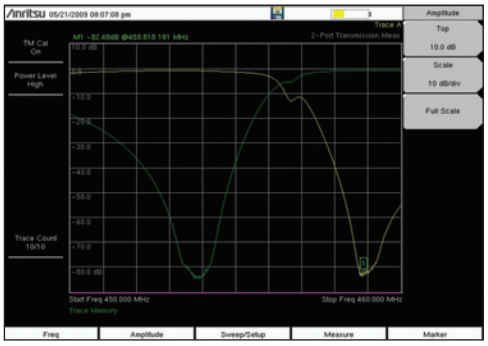
Passive and Active Tracking Generator Measurements



Tracking Generator Measurements

Tracking Generator (Option 20)

Spectrum Master's Tracking Generator capability allows you to make gain, isolation and insertion loss measurements of passive and active devices such as filters, cables, attenuators, duplexers, and tower mounted amplifiers. The Tracking Generator can also be used to make antenna-to-antenna isolation measurements and for repeater testing. The output power level can be varied from -50 dBm to 0 dBm in 0.1 dB steps.



Bias Tee (Option 10)

The built-in bias tee can be turned on as needed to place +12V to +32V on the center conductor of the RF In port, eliminating the need for you to carry external supplies in the field.

Duplexers

Fast sweep speeds, 80 dB dynamic range, and easy-to-use trace math menus make the Spectrum Master well suited for duplexer applications.

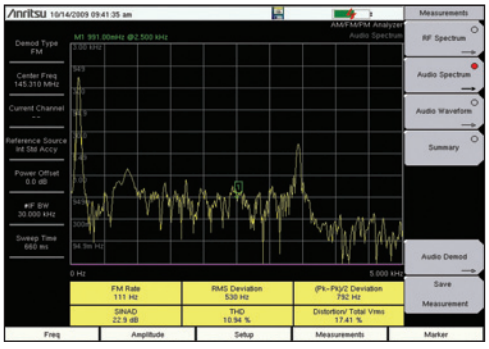
Valuable Options and Features

GPS Receiver

GPS Receiver (Option 31)

Spectrum Master's GPS option can be used to confirm the exact measurement location (longitude, latitude, altitude) and Universal Time (UTC) information. Each trace can be stamped with location information to ensure you are taking measurements at the right location.

In addition, the GPS option enhances the frequency accuracy of the internal reference oscillator. Within three minutes of acquiring the GPS satellite, the built-in GPS receiver provides a frequency accuracy to better than 50 ppb.



AM/FM/PM Analyzer

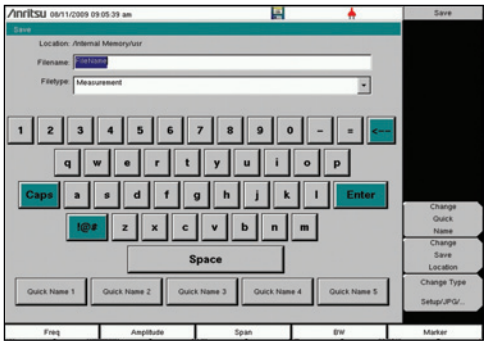
AM/FM/PM Analyzer (Option 509)

The AM/FM/PM analyzer provides analysis and display of analog modulation. Four measurement displays are provided.

The RF Spectrum display shows the spectrum with carrier power, frequency, and occupied BW. The Audio Spectrum display shows the demodulated audio spectrum along with the Rate, RMS deviation, Pk-Pk/2 deviation, SINAD, Total Harmonic Distortion (THD), and Distortion/Total. Audio Waveform display shows the time-domain demodulated waveform. Finally, there is a Summary Table Display that includes all the RF and Demod parameters.

Built-in Keyboard

The built-in touchscreen keyboard gives you access to a fully functional keyboard, saving valuable time in the field when entering trace names. You can create shortcuts to customer-configurable user "quick names" to program frequently used words.



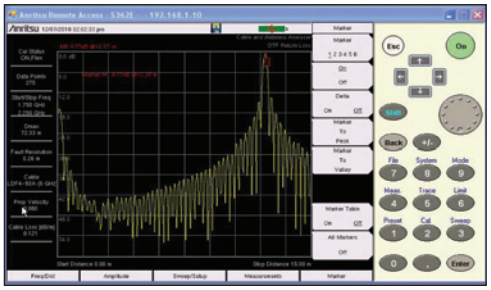
Touchscreen keyboard

Ethernet Connectivity (Option 0411)

By enabling the MS2712E/MS2713E to communicate with PCs via Ethernet, you gain the ability to operate automated testing from your PC, or conversely, to upload data from field test to the PC. By using the Remote Access Tool (a utility provided with Anritsu's Master Software Tools), remote access control is provided.

Local Language Support

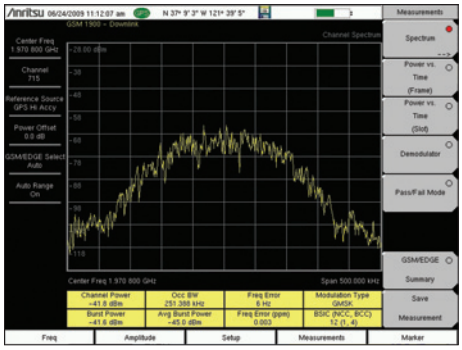
Spectrum Master features eight languages, including English, Japanese, Chinese, Italian, French, German, Spanish, and Korean. Two custom user-defined languages can be uploaded into the instrument using Master Software Tools.



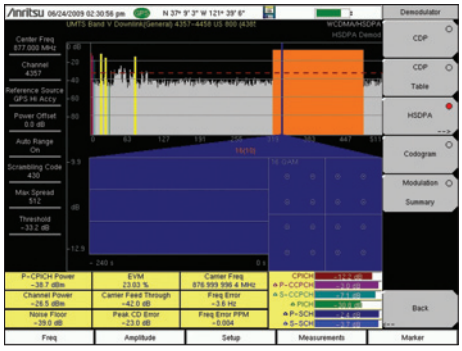
Remote Access Screen

Spectrum Master™ Compact Handheld Spectrum Analyzer Features

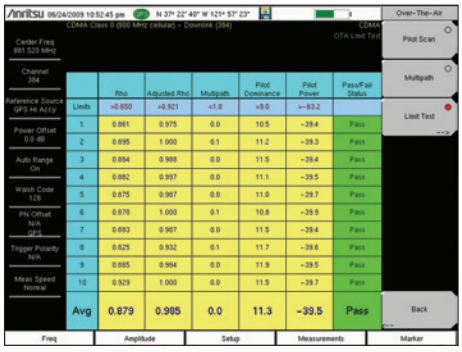
Introduction to Signal Analyzers



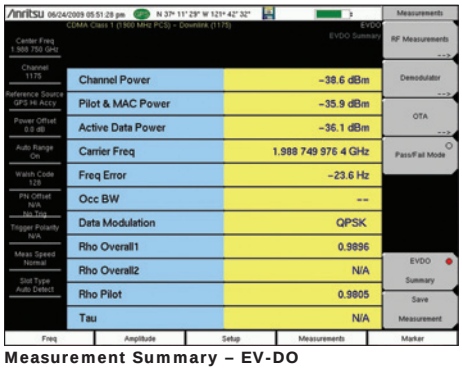
RF Measurement – GSM
High Frequency Error will cause calls to drop when mobiles travel at higher speed. In some cases, cell phones cannot hand off into, or out of the cell.



Demodulation – HSDPA
This is the single most important signal quality measurement. Poor EVM leads to dropped calls, low data rate, low sector capacity, and blocked calls.



Over-the- Air Measurement - CDMA
Having low multi-path and high pilot dominance is required for quality Rho measurements OTA. Poor Rho leads to dropped and blocked calls, and low data rate.



Measurement Summary – EV-DO
Having a summary of all key measurements is a quick way for a technician to see the health of the base station and record the measurements for reference.

Signal Analyzers

The Spectrum Master features Signal Analyzers for the major wireless standards around the world. The Signal Analyzers are designed to test and verify the:

- RF Quality
- Modulation Quality
- Downlink Coverage Quality

of the base stations' transmitters. The goal of these tests are to improve the Key Performance Indicators (KPIs) associated with:

- Call Drop Rate
- Call Block Rate
- Call Denial Rate

By understanding which test to perform on the Spectrum Master when the KPIs degrade to an unacceptable level, a technician can troubleshoot down to the Field Replacement Unit (FRU) in the base station's transmitter chain. This will minimize the problem of costly no trouble founds (NTF) associated with card swapping. This will allow you to have a lower inventory of spare parts as they are used more efficiently.

Troubleshooting Guides

The screen shots on this page are all measurements made over-the-air with the MS2713E on commercial base stations carrying live traffic. To understand when, where, how, and why you make these measurements Anritsu publishes Troubleshooting Guides which explains for each measurement the:

- Guidelines for a good measurement
- Consequences of a poor measurement
- Common Faults in a base station

These *Troubleshooting Guides for Base Stations* are one-page each per Signal Analyzer. They are printed on tear-resistant and smudge-resistant paper and are designed to fit in the soft case of the instrument for easy reference in the field. They are complimentary and their part numbers can be found in the ordering information.

- GSM/EDGE Base Stations
- W-CDMA/HSPA+ Base Stations
- CDMA2000 1X Base Stations
- CDMA2000 1xEV-DO Base Stations
- Fixed WiMAX Base Stations
- Mobile WiMAX Base Stations
- TD-CDMA/HSPA+ Base Station

Signal Analyzers

GSM/EDGE
W-CDMA/HSPA+
cdmaOne/CDMA2000 1X
CDMA2000 1xEV-DO
Fixed WiMAX
Mobile WiMAX
TD-SCDMA

Typical Signal Analyzer Options

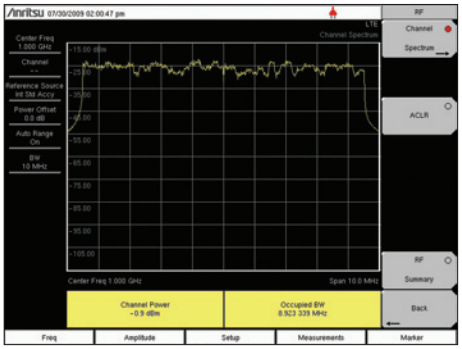
RF Measurements
Demodulation
Over-the-Air Measurements

Signal Analyzer Features

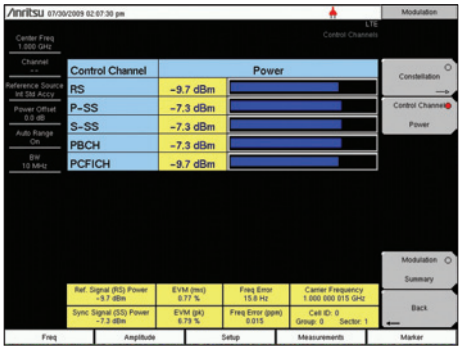
Measurement Summary Display
Pass/Fail Limit Testing

Spectrum Master™ Compact Handheld Spectrum Analyzer Features

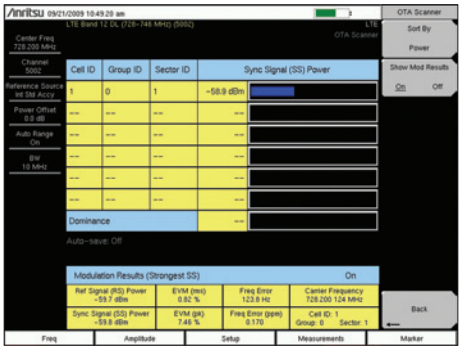
LTE Signal Analyzers (Option 0541, 0542, 0546, 0551, 0552, 0556)



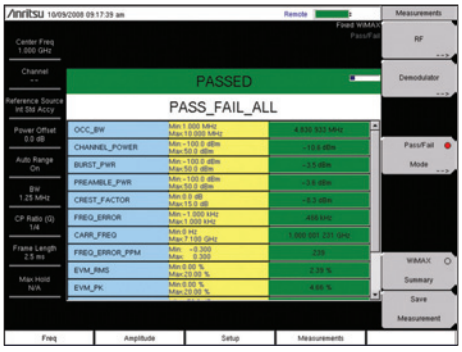
RF Measurements – Occupied Bandwidth
The bandwidth that contains 99% of the total carrier power. Excessive occupied bandwidth means excessive adjacent channel interference.



Modulation Quality – EVM
High or low values will create larger areas of cell-to-cell interference and create lower data rates near cell edges. Low values affect in-building coverage.



Over-the-Air Measurements – Sync Signal Power
Check for uneven amplitude of sub-carriers. Data will be less reliable on weak sub-carriers, creating a lower over-all data rate.



Pass/Fail Test
Set up common test limits, or sets of limits, for each instrument. Inconsistent settings between base stations, leads to inconsistent network behavior.

LTE Signal Analyzers

The Spectrum Master features three LTE measurement modes:

- RF Measurements
- Modulation Measurements
- Over-the-Air Measurements (OTA)

The goal of these measurements is to increase data rate and capacity by accurate power settings, ensuring low out-of-channel emissions, and good signal quality. These attributes help to create a low dropped call rate, a low blocked call rate, and a good customer experience.

Cell site technicians or RF engineers can make measurements Over-the-Air (OTA) to spot-check a transmitter's coverage and signal quality without taking the cell site off-line. When the OTA test results are ambiguous one can directly connect to the base station to check the signal quality and transmitter power.

Adjacent Channel Leakage Ratio (ACLR)

Adjacent Channel Leakage Ratio (ACLR) measures how much BTS signal gets into neighboring RF channels. ACLR checks the closest (adjacent) and the second closest (alternate) channels. Poor ACLR can lead to interference with adjacent carriers and legal liability. It also can indicate poor signal quality which leads to low throughput.

Cell ID (Sector ID, Group ID)

Cell ID indicates which base station is being measured OTA. The strongest base station at your current location is selected for measurement. Wrong values for Cell ID lead to inability to register. If the cause is excessive overlapping coverage, it also will lead to poor EVM and low data rates

Frequency Error

Frequency Error is a check to see that the carrier frequency is precisely correct. The Spectrum Master can accurately measure Carrier Frequency Error OTA if the instrument is GPS enabled. Calls will drop when mobiles travel at higher speed. In some cases, cell phones cannot hand off into, or out of the cell.

Sync Signal Mapping

Sync Signal Scanner can be used with the GPS to save scan results for later display on a map. The EVM of the strongest synch signal available at that spot is also recorded. The Cell, Sector, and Group ID information is also included so that it's easier to interpret the results. Once the Synch Signals are mapped, it becomes much easier to understand and troubleshoot any interference or coverage issues.

RF Measurements (Option 0541 FDD) (Option 0551 TDD)

- Channel Spectrum
  - Channel Power
  - Occupied Bandwidth
- Power vs. Time (TDD only)
  - Frame View
  - Sub-Frame View
  - Total Frame Power
  - DwPTS Power
  - Transmit Off Power
  - Cell ID
  - Timing Error
- ACPR
- Spectral Emission Mask
  - Category A or B (Opt 1)
- RF Summary

Modulation Measurements (Option 0542 FDD) (Option 0552 TDD)

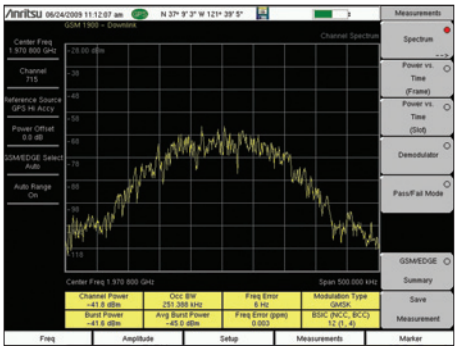
- Power vs. Resource Block (RB)
  - RB Power (PDSCH)
  - Active RBs, Utilization %
  - Channel Power, Cell ID
  - OSTP, Frame EVM by modulation (FDD only)
- Constellation
  - OPSK, 16 QAM, 64 QAM
  - Modulation Results
    - Ref Signal Power (RS)
    - Sync Signal Power (SS)
    - EVM – rms, peak, max hold
    - Frequency Error – Hz, ppm
    - Carrier Frequency
    - Cell ID
- Control Channel Power
  - Bar Graph or Table View
  - RS, P-SS, S-SS
  - PBCH, PCFICH, PHICH, PDCCH
  - Total Power (Table View)
  - EVM
  - Modulation Results
- Tx Time Alignment
- Modulation Summary
  - Includes EVM by modulation
  - (FDD only)
- Antenna Icons
  - Detects active antennas (1/2)

Over-the-Air (OTA) (Option 0546 FDD) (Option 0556 TDD)

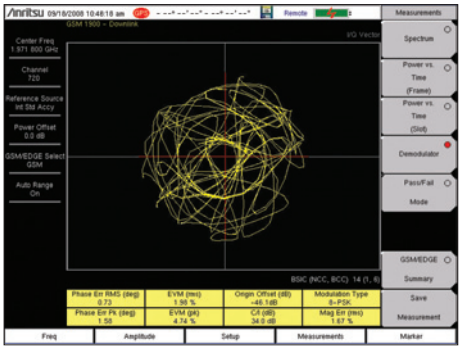
- Scanner
  - Cell ID (Group, Sector)
  - S-SS Power, RSRP, RSRQ, SINR
  - Dominance
  - Modulation Results – On/Off
- Tx Test
  - Scanner
  - RS Power of MIMO antennas
    - Cell ID, Average Power
    - Delta Power (Max-Min)
    - Graph of Antenna Power
    - Modulation Results – On/Off
- Mapping
  - On-screen
    - S-SS Power, RSRP, RSRQ, or SINR
  - Scanner
    - Modulation Results – Off

Spectrum Master™ Compact Handheld Spectrum Analyzer Features

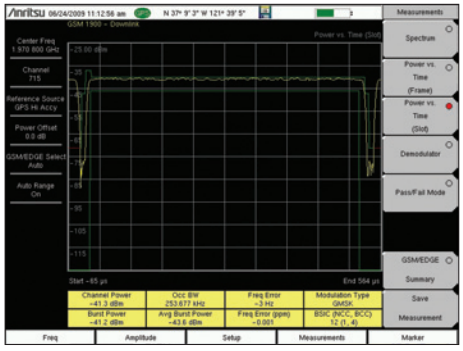
GSM/EDGE Signal Analyzers (Options 0040, 0041)



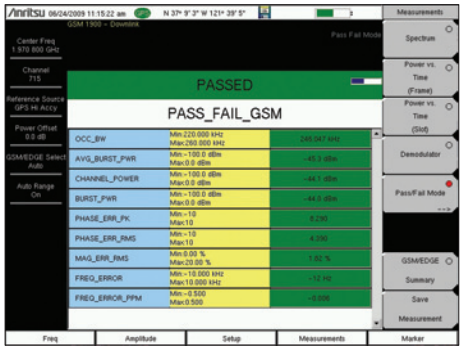
RF Measurement – Occupied Bandwidth
Excessive occupied bandwidth can create interference with adjacent channels or be a sign of poor signal quality, leading to dropped calls.



Demodulation – Error Vector Magnitude (EVM)
This is the single most important signal quality measurement. Poor EVM leads to dropped calls, low data rate, low sector capacity, and blocked calls.



RF Measurement – Average Burst Power
High or low values will create larger areas of cell-to-cell interference and create lower data rates near cell edges. Low values create dropouts and dead zones.



Pass/Fail Test
Set up common test limits, or sets of limits, for each instrument. Inconsistent settings between base stations, leads to inconsistent network behavior.

GSM/EDGE Analyzers

The Spectrum Master features two GSM/EDGE measurement modes.

- RF Measurements
- Demodulation

The goal of these measurements is to increase data rate and capacity by accurate power settings, ensuring low out-of-channel emissions, and good signal quality. These attributes help to create a low dropped call rate, a low blocked call rate, and a good customer experience.

Cell site technicians or RF engineers can make measurements Over-the-Air (OTA) to spot-check a transmitter's coverage and signal quality without taking the cell site off-line. When the OTA test results are ambiguous one can directly connect to the base station to check the signal quality and transmitter power.

For easy identification of which cell you are measuring the Base Station Identity Code (BSIC) gives the base station id, the Network Color Code (NCC) identifies the owner of the network, and the Base Station Color Code (BCC) provides the sector information.

Carrier-to-Interference (C/I)

C/I indicates the quality of the received signal. It also can be used to identify areas of poor signal quality. Low C/I ratios will cause coverage issues including dropped calls, blocked calls, and other handset reception problems.

Phase Error

Phase Error is a measure of the phase difference between an ideal and actual GMSK modulated voice signal. High phase error leads to dropped calls, blocked calls, and missed handoffs.

Origin Offset

Origin Offset is a measure of the DC power leaking through local oscillators and mixers. A high Origin Offset will lower EVM and Phase Error measurements and create higher dropped call rates.

Power versus Time (Slot and Frame)

Power versus Time (Slot and Frame) should be used if the GSM base station is setup to turn RF power off between timeslots. When used OTA, this measurement can also spot GSM signals from other cells. Violations of the mask create dropped calls, low capacity, and small service area issues.

RF Measurements (Option 0040)

Channel Spectrum
- Channel Power
- Occupied Bandwidth
- Burst Power
- Average Burst Power
- Frequency Error
- Modulation Type
- BSIC (NCC, BCC)

Multi-channel Spectrum

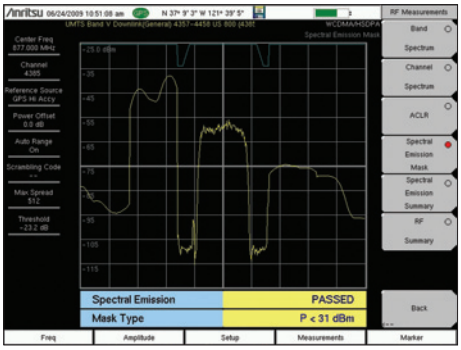
Power vs. Time (Frame/Slot)
- Channel Power
- Occupied Bandwidth
- Burst Power
- Average Burst Power
- Frequency Error
- Modulation Type
- BSIC (NCC, BCC)

Demodulation (Option 0041)

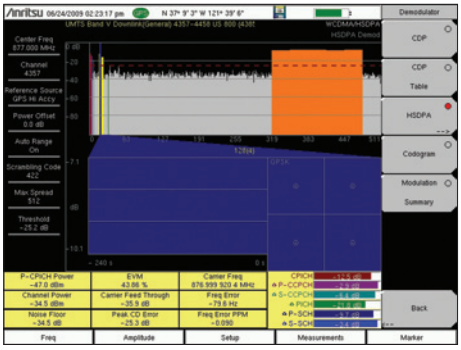
Phase Error
EVM
Origin Offset
C/I
Modulation Type
Magnitude Error
BSIC (NCC, BCC)

Spectrum Master™ Compact Handheld Spectrum Analyzer Features

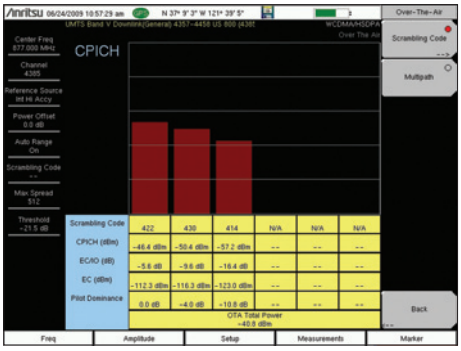
W-CDMA/HSPA+ Signal Analyzers (Options 0044, 0065, 0035)



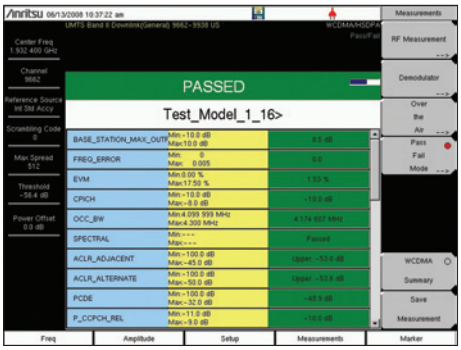
RF Measurements – Spectral Emissions Mask
The 3GPP spectral emission mask is displayed. Failing this test leads to interference with neighboring carriers, legal liability, and low signal quality.



Demodulation – Error Vector Magnitude (EVM)
This is the single most important signal quality measurement. Poor EVM leads to dropped calls, low data rate, low sector capacity, and blocked calls.



Over-the-Air Measurements – Scrambling Codes
Too many strong sectors at the same location creates pilot pollution. This leads to low data rate, low capacity, and excessive soft handoffs.



Pass/Fail Test
Set up common test limits, or sets of limits, for each instrument. Inconsistent settings between base stations leads to inconsistent network behavior.

W-CDMA/HSPA+ Signal Analyzers

The Spectrum Master features four W-CDMA/HSPA+ measurement modes:

- RF Measurements
- Demodulation (two choices)
- Over-the Air Measurements (OTA)

The goal of these measurements is to increase data rate and capacity by accurate power settings, ensuring low out-of-channel emissions, and good signal quality. These attributes help to create a low dropped call rate, a low blocked call rate, and a good customer experience.

Cell site technicians or RF engineers can make measurements Over-the-Air (OTA) to spot-check a transmitter's coverage and signal quality without taking the Node B off-line. When the OTA test results are ambiguous one can directly connect to the base station to check the signal quality and transmitter power.

Frequency Error

Frequency Error is a check to see that the carrier frequency is precisely correct. The Spectrum Master can accurately measure Carrier Frequency Error OTA if the instrument is GPS enabled. Calls will drop when mobiles travel at higher speed. In some cases, cell phones cannot hand off into, or out of the cell.

Peak Code Domain Error (PCDE)

Peak Code Domain Error is a measure of the errors between one code channel and another. High PCDE causes dropped calls, low signal quality, low data rate, low sector capacity, and blocked calls.

Multipath

Multipath measurements show how many, how long, and how strong the various radio signal paths are. Multipath signals outside tolerances set by the cell phone or other UE devices become interference. The primary issue is co-channel interference leading to dropped calls and low data rates.

Pass/Fail Mode

The Spectrum Master stores the five test models covering all eleven test scenarios specified in the 3GPP specification (TS 25.141) for testing base station performance and recalls these models for quick easy measurements.

RF Measurements (Option 0044)

- Band Spectrum
- Channel Spectrum
  - Channel Power
  - Occupied Bandwidth
  - Peak-to-Average Power
- Spectral Emission Mask
- Single carrier ACLR
- Multi-carrier ACLR
- RF Summary

Demodulation (Option 0065)

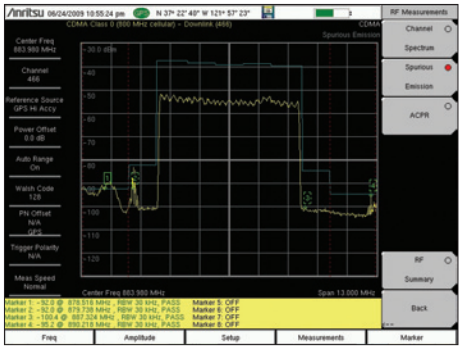
- Code Domain Power Graph
  - P-CPICH Power
  - Channel Power
  - Noise Floor
  - EVM
  - Carrier Feed Through
  - Peak Code Domain Error
  - Carrier Frequency
  - Frequency Error
  - Control Channel Power
  - Abs/Rel/Delta Power
    - CPICH, P-CCPCH
    - S-CCPCH, PICH
    - P-SCH, S-SCH
  - HSPA+
    - Power vs. Time
    - Constellation
- Code Domain Power Table
  - Code, Status
  - EVM, Modulation Type
  - Power, Code Utilization
  - Power Amplifier Capacity
- Codogram
- Modulation Summary

Over-the-Air (OTA) Measurements (Option 0035)

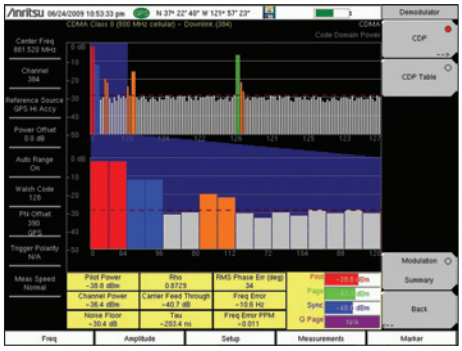
- Scrambling Code Scanner (Six)
  - Scrambling Codes
  - CPICH
  - E_C/I_O
  - E_C
  - Pilot Dominance
  - OTA Total Power
- Multipath Scanner (Six)
  - Six Multipaths
  - Tau
  - Distance
  - RSCP
  - Relative Power
  - Multipath Power

Spectrum Master™ Compact Handheld Spectrum Analyzer Features

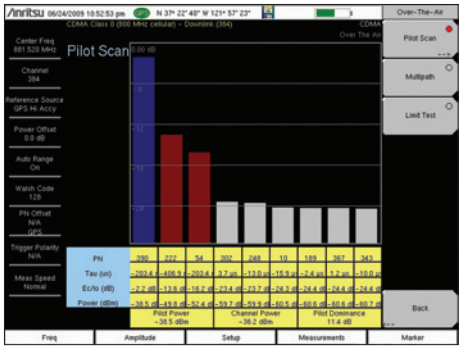
CDMA Signal Analyzers (Options 0042, 0043, 0033)



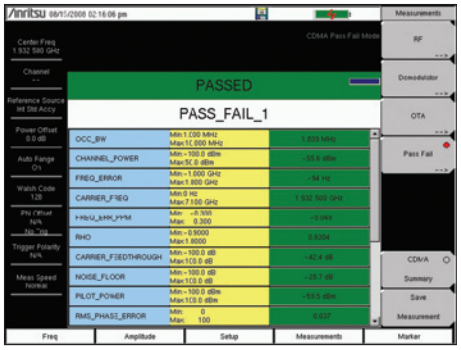
RF Measurements – Spectral Emissions Mask
The 3GPP spectral emission mask is displayed. Failing this test leads to interference with neighboring carriers, legal liability, and low signal quality.



Modulation Quality – EVM
High or low values will create larger areas of cell-to-cell interference and create lower data rates near cell edges. Low values affect in-building coverage.



Over-the-Air Measurements – Sync Signal Power
Check for uneven amplitude of sub-carriers. Data will be less reliable on weak sub-carriers, creating a lower over-all data rate.



Pass / Fail Test
Set up common test limits, or sets of limits, for each instrument. Inconsistent settings between base stations leads to inconsistent network behavior.

CDMA Signal Analyzers

The Spectrum Master features three CDMA measurement modes:

- RF Measurements
- Demodulation
- Over-the Air Measurements (OTA)

The goal of these measurements is to increase data rate and capacity by accurate power settings, ensuring low out-of-channel emissions, and good signal quality. These attributes help to create a low dropped call rate, a low blocked call rate, and a good customer experience.

Cell site technicians or RF engineers can make measurements Over-the-Air (OTA) to spot-check a transmitter's coverage and signal quality without taking the cell site off-line. When the OTA test results are ambiguous one can directly connect to the base station to check the signal quality and transmitter power.

Adjacent Channel Power Ratio (ACPR)

ACPR measures how much of the carrier gets into neighboring RF channels. ACPR, and multi-channel ACPR, check the closest (adjacent) and second closest (alternate) RF channels for single and multicarrier signals. High ACPR will create interference for neighboring carriers. This is also an indication of low signal quality and low capacity, which can lead to blocked calls.

RMS Phase Error

RMS Phase Error is a measure of signal distortion caused by frequency instability. Any changes in the reference frequency or the radio's internal local oscillators will cause problems with phase error. A high reading will cause dropped calls, low signal quality, low data rate, low sector capacity, and blocked calls.

Noise Floor

Noise Floor is the average level of the visible code domain noise floor. This will affect Rho. A high noise floor will result in dropped calls, low signal quality, low data rate, low sector capacity, and blocked calls.

E_c / I_o

E_c/I_o indicates the quality of the signal from each PN. Low E_c/I_o leads to low data rate and low capacity.

RF Measurements (Option 0042)

- Channel Spectrum
  - Channel Power
  - Occupied Bandwidth
  - Peak-to-Average Power
- Spectral Emission Mask
- Multi-carrier ACPR
- RF Summary

Demodulation (Option 0043)

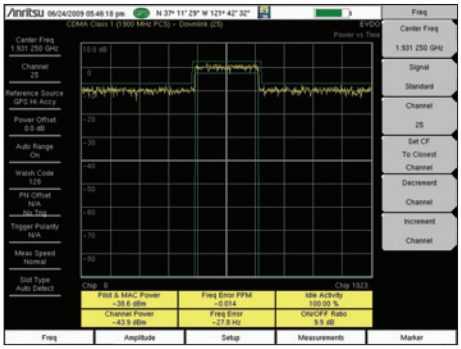
- Code Domain Power Graph
  - Pilot Power
  - Channel Power
  - Noise Floor
  - Rho
  - Carrier Feed Through
  - Tau
  - RMS Phase Error
  - Frequency Error
  - Abs/Rel/ Power
    - Pilot
    - Page
    - Sync
    - Q Page
- Code Domain Power Table
  - Code
  - Status
  - Power
  - Multiple Codes
  - Code Utilization
- Modulation Summary

Over-the-Air (OTA) Measurements (0ption 0033)

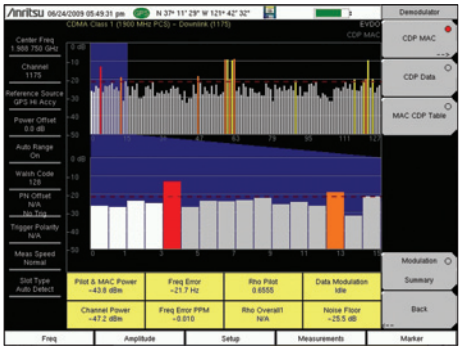
- Pilot Scanner (Nine)
  - PN
  - E_c/I_o
  - Tau
  - Pilot Power
  - Channel Power
  - Pilot Dominance
- Multipath Scanner (Six)
  - E_c/I_o
  - Tau
  - Channel Power
  - Multipath Power
- Limit Test – 10 Tests Averaged
  - Rho
  - Adjusted Rho
  - Multipath
  - Pilot Dominance
  - Pilot Power
  - Pass/Fail Status

Spectrum Master™ Compact Handheld Spectrum Analyzer Features

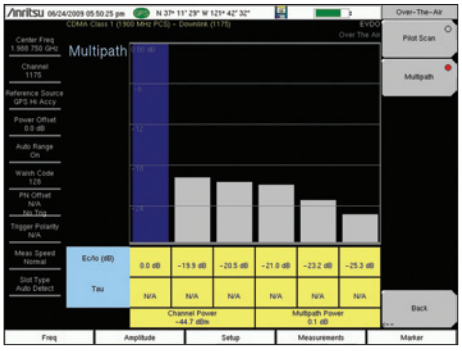
EV-DO Signal Analyzers (Options 0062, 0063, 0034)



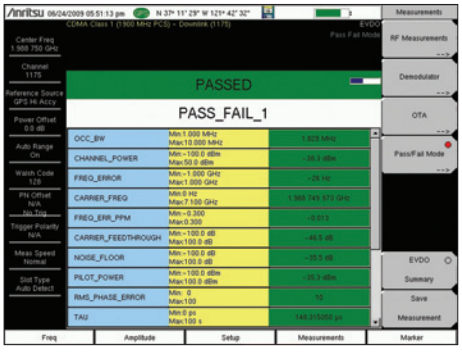
RF Measurements – Pilot and MAC Power
High values will create pilot pollution. High or low values will cause dead spots/dropped calls and cell loading imbalances/blocked calls.



Demodulation – Frequency Error
Calls will drop when mobiles travel at higher speed. In some cases, cell phones cannot hand off into, or out of the cell, creating island cells.



Over-the-Air Measurements – Multipath
Too much Multipath from the selected PN Code is the primary issue of co-channel interference leading to dropped calls and low data rates.



Pass/Fail Test
Set up common test limits, or sets of limits, for each instrument. Inconsistent settings between base stations leads to inconsistent network behavior.

EV-DO Signal Analyzers

The Spectrum Master features three EV-DO measurement modes.

- RF Measurements
- Demodulation
- Over-the Air Measurements (OTA)

The goal of these measurements is to increase data rate and capacity by accurate power settings, ensuring low out-of-channel emissions, and good signal quality. These attributes help to create a low dropped call rate, a low blocked call rate, and a good customer experience.

Cell site technicians or RF engineers can make measurements Over-the-Air (OTA) to spot-check a transmitter's coverage and signal quality without taking the cell site off-line. When the OTA test results are ambiguous one can directly connect to the base station to check the signal quality and transmitter power.

Spectral Emission Mask (SEM)

SEM is a way to check out-of-channel spurious emissions near the carrier. These spurious emissions both indicate distortion in the signal and can create interference with carriers in the adjacent channels. Faults lead to interference and thus, lower data rates, for adjacent carriers. Faults also may lead to legal liability and low in-channel signal quality.

Rho

Rho is a measure of modulation quality. Rho Pilot, Rho Mac, and Rho Data are the primary signal quality tests for EV-DO base stations. Low Rho results in dropped calls, low signal quality, low data rate, low sector capacity, and blocked calls. This is the single most important signal quality measurement.

PN Codes

PN Code overlap is checked by the pilot scanner. Too many strong pilots create pilot pollution which results in low data rate, low capacity, and excessive soft handoffs.

Over-the-Air (OTA) Pilot Power

OTA Pilot Power indicates signal strength. Low OTA Pilot Power causes dropped calls, low data rate, and low capacity.

RF Measurements (Option 0062)

- Channel Spectrum
  - Channel Power
  - Occupied Bandwidth
  - Peak-to-Average Power
- Power vs. Time
  - Pilot & MAC Power
  - Channel Power
  - Frequency Error
  - Idle Activity
  - On/Off Ratio
- Spectral Emission Mask
- Multi-carrier ACPR
- RF Summary

Demodulation (Option 0063)

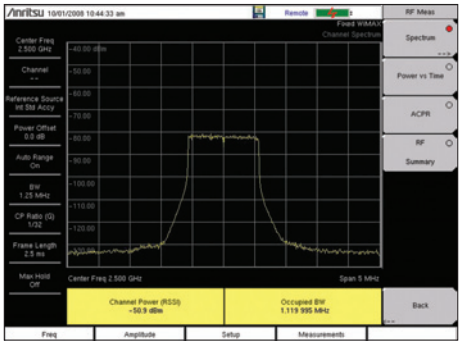
- MAC Code Domain Power Graph
  - Pilot & MAC Power
  - Channel Power
  - Frequency Error
  - Rho Pilot
  - Rho Overall
  - Data Modulation
  - Noise Floor
- MAC Code Domain Power Table
  - Code
  - Status
  - Power
  - Code Utilization
- Data Code Domain Power
  - Active Data Power
  - Data Modulation
  - Rho Pilot
  - Rho Overall
  - Maximum Data CDP
  - Minimum Data CDP
- Modulation Summary

Over-the-Air (OTA) Measurements (Option 0034)

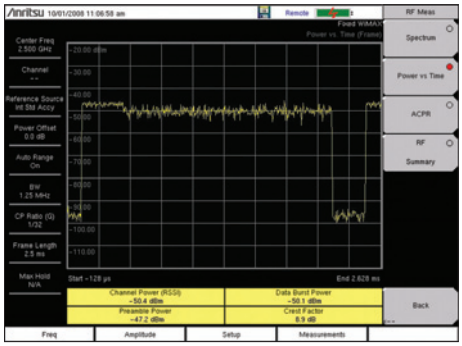
- Pilot Scanner (Nine)
  - PN
  - E_c/I_o
  - Tau
  - Pilot Power
  - Channel Power
  - Pilot Dominance
- Mulitpath Scanner (Six)
  - E_c/I_o
  - Tau
  - Channel Power
  - Multipath Power

Spectrum Master™ Compact Handheld Spectrum Analyzer Features

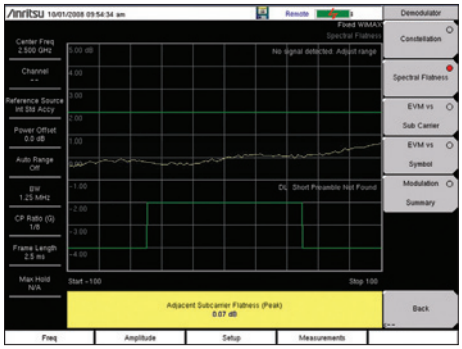
Fixed WiMAX Signal Analyzers (Options 0046, 0047)



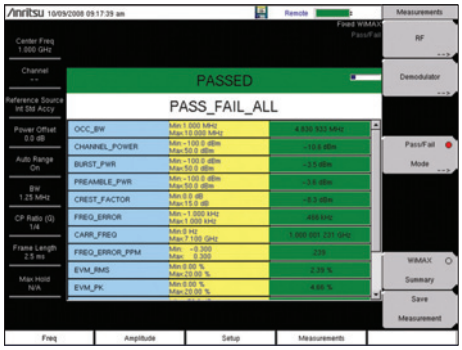
RF Measurements – Occupied Bandwidth
The bandwidth that contains 99% of the total carrier power. Excessive occupied bandwidth means excessive adjacent channel interference.



RF Measurement – Preamble Power
High or low values will create larger areas of cell-to-cell interferences and create lower data rates near cell edges. Low values affect in-building coverage.



Demodulation – Spectral Flatness
Check for uneven amplitude of sub-carriers. Data will be less reliable on weak sub-carriers, creating a lower over-all data rate.



Pass/Fail Test
Set up common test limits, or sets of limits, for each instrument. Inconsistent settings between base stations leads to inconsistent network behavior.

Fixed WiMAX Signal Analyzers

The Spectrum Master features two Fixed WiMAX measurement modes:

- RF Measurements
- Demodulation

The goal of these measurements is to increase data rate and capacity by accurate power settings, ensuring low out-of-channel emissions, and good signal quality. These attributes help to create a low dropped call rate, a low blocked call rate, and a good customer experience.

Cell site technicians or RF engineers can make measurements Over-the-Air (OTA) to spot-check a transmitter's coverage and signal quality without taking the cell site off-line. When the OTA test results are ambiguous one can directly connect to the base station to check the signal quality and transmitter power.

Adjacent Channel Power Ratio (ACPR)

Adjacent Channel Power Ratio (ACPR) measures how much BTS signal gets into neighboring RF channels. ACPR checks the closest (adjacent) and the second closest (alternate) channels. Poor ACPR can lead to interference with adjacent carriers and legal liability. It also can indicate poor signal quality which leads to low throughput.

Base Station ID

Base Station ID indicates which base station is being measured OTA. The strongest base station at your current location is selected for measurement. Wrong values for base station ID lead to inability to register. If the cause is excessive overlapping coverage, it also will lead to poor RCE and low data rates.

Relative Constellation Error (RCE)

RCE, when used Over-the-Air (OTA), is a test that is ideal for checking received signal quality. High RCE leads directly to low data rate, which creates dissatisfied customers and lowers the data capacity of the sector. Very high RCE results in dropped calls, timeouts, and inability to register.

Adjacent Subcarrier Flatness (Peak)

Adjacent Subcarrier Flatness (Peak) is measured between one sub-carrier and the next. Poor flatness will give the weaker sub-carriers a high bit error rate and lower capacity. Data will be less reliable on weak sub-carriers, creating a lower over-all data rate.

RF Measurements (Option 0046)

Channel Spectrum
- Channel Power
- Occupied Bandwidth

Power vs. Time
- Channel Power
- Preamble Power
- Data Burst Power
- Crest Factor

ACLR

RF Summary

Demodulation (Option 0047)

Constellation
- RCE (RMS/Peak)
- EVM (RMS/Peak)
- Frequency Error
- Carrier Frequency
- Base Station ID

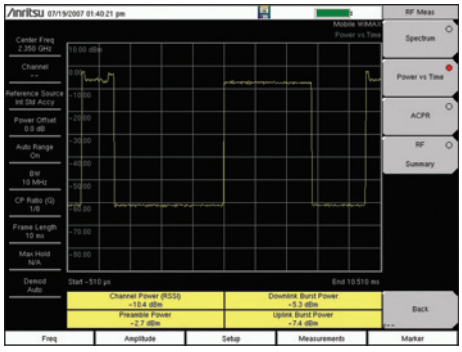
Spectral Flatness
- Adjacent Subcarrier Flatness

EVM vs. Subcarrier/Symbol
- RCE
- EVM
- Frequency Error
- Carrier Frequency
- Base Station ID

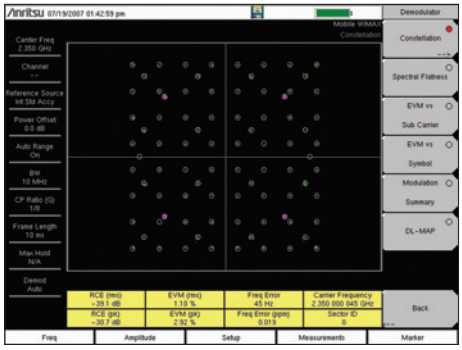
Modulation Summary

Spectrum Master™ Compact Handheld Spectrum Analyzer Features

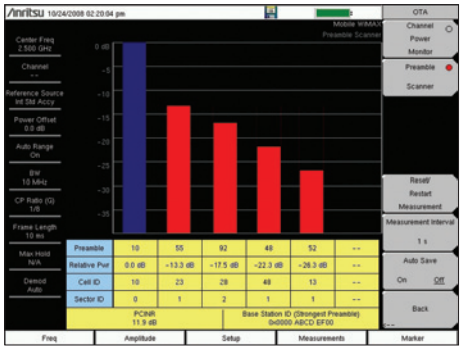
Mobile WiMAX* Signal Analyzers (Options 0066, 0067, 0037)



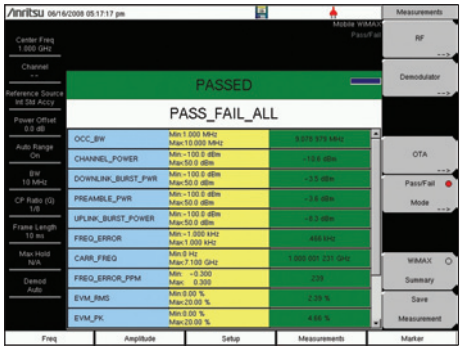
RF Measurement – Preamble Power
High or low values will create larger areas of cell-to-cell interference and create lower data rates near cell edges. Low values affect in-building coverage.



Demodulation – Frequency Error
Calls will drop when user's equipment travels at high speed. In severe cases, handoffs will not be possible at any speed, creating island cells.



Over-the-Air Measurements – PCINR
A low Physical Carrier to Interference plus Noise Ratio (PCINR) indicates poor signal quality, low data rate and reduced sector capacity.



Pass/Fail Test
Set up common test limits, or sets of limits, for each instrument. Inconsistent settings between base stations leads to inconsistent network behavior.

Mobile WiMAX Signal Analyzers

The Spectrum Master features three Mobile WiMAX measurement modes:

- RF Measurements
- Demodulation
- Over-the Air Measurements (OTA)

The goal of these measurements is to increase data rate and capacity by accurate power settings, ensuring low out-of-channel emissions, and good signal quality. These attributes help to create a low dropped call rate, a low blocked call rate, and a good customer experience.

Cell site technicians or RF engineers can make measurements Over-the-Air (OTA) to spot-check a transmitter's coverage and signal quality without taking the cell site off-line. When the OTA test results are ambiguous one can directly connect to the base station to check the signal quality and transmitter power.

Cell ID, Sector ID, and Preamble

Cell ID, Sector ID, and Preamble show which cell, sector, and segment are being measured OTA. The strongest signal is selected automatically for the additional PCINR and Base Station ID measurement. Wrong values for cell, sector and segment ID lead to dropped handoffs and island cells. If the cause is excessive coverage, it also will lead to large areas of low data rates.

Error Vector Magnitude (EVM) Relative Constellation Error (RCE)

RCE and EVM measure the difference between the actual and ideal signal. RCE is measured in dB and EVM in percent. A known modulation is required to make these measurements. High RCE and EVM causes low signal quality, low data rate, and low sector capacity. This is the single most important signal quality measurement.

Preamble Mapping (Mobile WiMAX)

Preamble Scanner can be used with the GPS to save scan results for later display on a map. PCINR ratio for the strongest WiMAX preamble available at that spot. The Base Station ID and Sector ID information are also included so that it's easier to interpret the results. Once PCINR data is mapped, it becomes much easier to understand and troubleshoot any interference or coverage issues.

RF Measurements (Option 0066)

Channel Spectrum
- Channel Power
- Occupied Bandwidth

Power vs. Time
- Channel Power
- Preamble Power
- Downlink Burst Power
- Uplink Burst Power

ACPR

RF Summary

Demodulation (Option 0067)

Constellation
- RCE (RMS/Peak)
- EVM (RMS/Peak)
- Frequency Error
- CINR
- Base Station ID
- Sector ID

Spectral Flatness
- Adjacent Subcarrier Flatness

EVM vs. Subcarrier/Symbol
- RCE (RMS/Peak)
- EVM (RMS/Peak)
- Frequency Error
- CINR
- Base Station ID
- Sector ID

DL-MAP (Tree View)

Modulation Summary

Over-the-Air (OTA) (Option 0037)

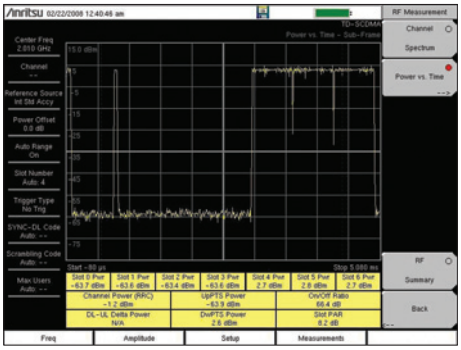
Channel Power Monitor

Preamble Scanner (Six)
- Preamble
- Relative Power
- Cell ID
- Sector ID
- PCINR
- Dominant Preamble
  - Base Station ID

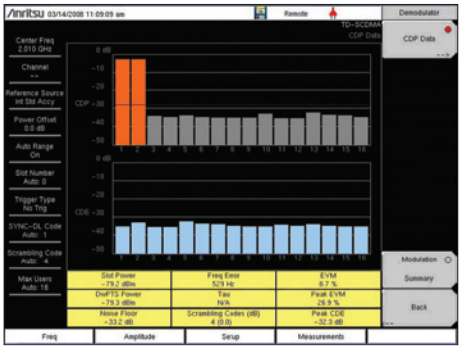
* Conforms to IEEE Std. 802.16e-2005, WiMAX Forum® Air Interface - Mobile System Profile - Release 1.0 Certified, System Profiles according to WMF-T24-001-R010v07.

Spectrum Master™ Compact Handheld Spectrum Analyzer Features

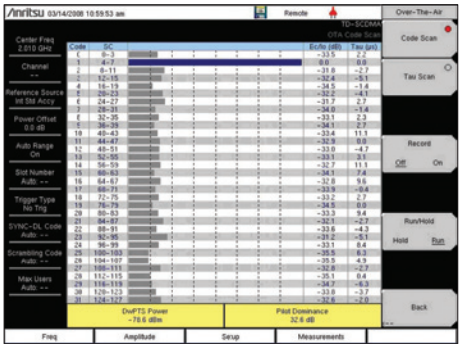
TD-SCDMA/HSPA+ Signal Analyzers (Options 0060, 0061, 0038)



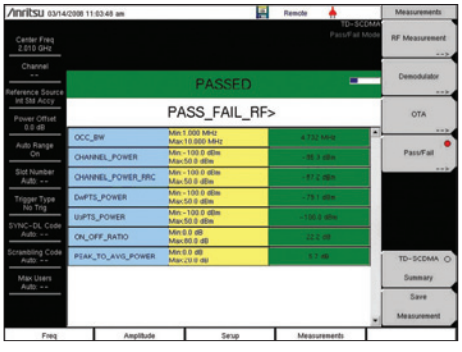
RF Measurement – Time Slot Power
Empty downlink slots with access power will reduce the sensitivity of the receiver and the size of the sector. This will cause dropped and blocked calls.



Demodulation – Scrambling Code
Scrambling Code measurements provide a check for the BTS settings. Scrambling Code errors can cause a very high dropped call rate on hand off.



Over-the-Air Measurements – Code Scanner
Excessive sync codes produce too much co-channel interference, which leads to lower capacity, low data rate and excessive handoffs.



Pass/Fail Test
Set up common test limits, or sets of limits, for each instrument. Inconsistent settings between base stations leads to inconsistent network behavior.

TD-SCDMA/HSPA+ Signal Analyzers

The Spectrum Master features three TD-SCDMA/HSPA+ measurement modes:

- RF Measurements
- Demodulation
- Over-the Air Measurements (OTA)

The goal of these measurements is to increase data rate and capacity by accurate power settings, ensuring low out-of-channel emissions, and good signal quality. These attributes help to create a low dropped call rate, a low blocked call rate, and a good customer experience.

Cell site technicians or RF engineers can make measurements Over-the-Air (OTA) to spot-check a transmitter's coverage and signal quality without taking the cell site off-line. When the OTA test results are ambiguous one can directly connect to the base station to check the signal quality and transmitter power.

Error Vector Magnitude (EVM) EVM is the ratio of errors, or distortions, in the actual signal, compared to a perfect signal. EVM faults will result in poor signal quality to all user equipment. In turn, this will result in extended hand off time, lower sector capacity, and lower data rates, increasing dropped and blocked calls.

Peak Code Domain Error (Peak CDE)

Peak CDE is the EVM of the worst code. Code Domain displays show the traffic in a specific time slot. Peak CDE faults will result in poor signal quality to all user equipment. In turn, this will result in extended hand off time, lower sector capacity, and lower data rates.

OTA Tau Scanner E_c / I_o

E_c/I_o faults indicate excessive or inadequate coverage and lead to low capacity, low data rates, extended handoffs, and excessive call drops.

DwPTS OTA Power Mapping

DwPTS OTA Power when added to E_c/I_o gives the absolute sync code power which is often proportional to PCCPCH (pilot) power. Use this to check and plot coverage with GPS. Coverage plots can be downloaded to PC based mapping programs for later analysis. Poor readings will lead to low capacity, low data rates, excessive call drops and call blocking.

RF Measurements (Option 0060)

- Channel Spectrum
  - Channel Power
  - Occupied Bandwidth
  - Left Channel Power
  - Left Channel Occ B/W
  - Right Channel Power
  - Right Channel Occ B/W
- Power vs. Time
  - Six Slot Powers
  - Channel Power (RRC)
  - DL-UL Delta Power
  - UpPTS Power
  - DwPTS Power
  - On/Off Ratio
  - Slot Peak-to-Average Power
- Spectral Emission
- RF Summary

Demodulation (Option 0061)

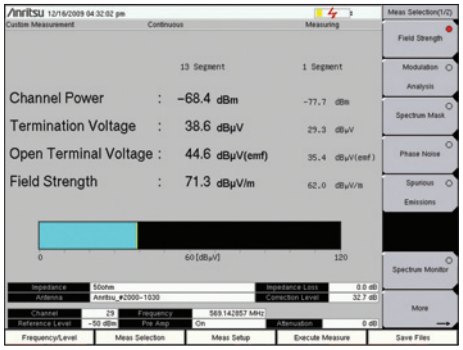
- Code Domain Power/Error
  - (QPSK/8 PSK/16 QAM)
  - Slot Power
  - DwPTS Power
  - Noise Floor
  - Frequency Error
  - Tau
  - Scrambling Code
  - EVM
  - Peak EVM
  - Peak Code Domain Error
- Modulation Summary

Over-the-Air (OTA) Measurements (Option 0038)

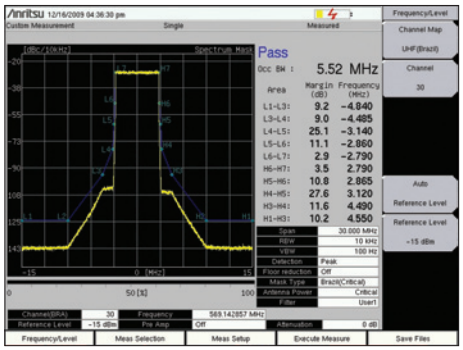
- Code Scan (32)
  - Scrambling Code Group
  - Tau
  - E_c/I_o
  - DwPTS Power
  - Pilot Dominance
- Tau Scan (Six)
  - Sync-DL#
  - Tau
  - E_c/I_o
  - DwPTS Power
  - Pilot Dominance

Spectrum Master™ Compact Handheld Spectrum Analyzer Features

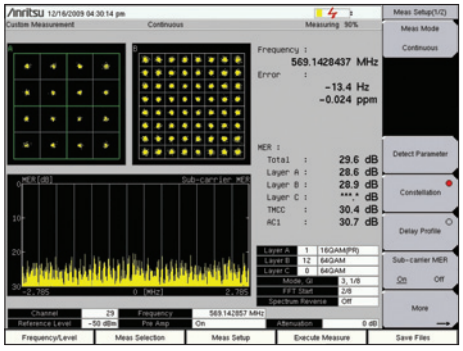
ISDB-T Signal Analyzers (Options 0030, 0079, 0032)



RF Measurements – Signal Power
The Signal Power screen showing the transmission channel power and signal field strength used to assess suitable reception coverage area.



RF Measurements – Spectrum Mask
The Spectrum Mask measurement is shown. ISDB-T systems in Japan and South America call for different spectrum mask specifications. Both are catered for.



Signal Analysis – Constellation and MER
This is the single most important signal quality measurement. Poor MER leads to higher received errors which can cause serious picture degradation.

SFN Analysis – Delay Profile
This measurement indicates whether signals from different transmitters in an SFN are received correctly to prevent interference and high received errors.

ISDB-T Signal Analyzer

The Spectrum Master features options that enable area survey measurements and the installation and field maintenance of ISDB-T digital broadcasting equipment in accordance with ARIB (Japan) and ABNT (Brazil) standards.

The user has three measurement modes to choose from depending on the his skill level and test environment: Custom, where specific measurements and setups are chosen; Easy, where some setup parameters are automatically set or detected; Batch, where the user can specify all relevant measurements, setups and channels for automatic measurement and results' display for fast and efficient field testing.

The goal of all measurements is to ensure digital TV transmitters are configured according to license agreements and optimized for error-free reception over the entire coverage area helping to create an excellent televisual experience.

Field Strength

Field Strength (dBµV/m) measurement enables a technician to assess whether signals will be detected at a location with sufficient power for good TV reception. The antenna factors of the antenna used for measurement can be compensated for to facilitate easy measurement comparison.

Modulation Error Ratio (MER)

MER is the fundamental measurement in digital TV broadcast systems. It quantifies the modulation signal quality directly. It is essential for managing signal margin and the deterioration of equipment with time, as well as for maintaining stable broadcast services. MER is independent of modulation type so MER measurements can be easily compared.

Delay Profile

This function measures the difference in time and frequency of multi-path signals caused by reflections from obstacles or from other transmitters. By measuring the channel frequency response, the multi-path effect or frequency selective fading can be observed. It is important that all signals from reflections or other transmitters are received within the guard interval to prevent inter-symbol interference which will cause reception degradation. Delay Profile measurement is useful for adjusting the timing of SFN repeaters to achieve this.

RF Measurements (Option 0030)

- Signal Power
  - Channel Power
  - Termination Voltage
  - Open Terminal Voltage
  - Field Strength
- Spectrum Monitor
  - Channel Power
  - Zone Center Channel
  - Zone Center Frequency
- Spectrum Mask
  - Mask (Standard A) Japan
  - Mask (Standard B) Japan
  - Mask (Critical) Brazil
  - Mask (Sub-critical) Brazil
  - Mask (Non-critical) Brazil
- Phase Noise
- Spurious Emissions

Signal Analysis (Option 0030)

- Constellation (w/zoom)
  - Layer A, B, C, TMCC
- Sub-carrier MER
- Delay Profile (w/zoom)
- Frequency Response
- Measured Data
  - Frequency
  - Frequency Offset
  - MER (Total, Layer A/B/C, TMCC, AC1)
  - Modulation (Layer A/B/C)
  - Mode, GI
  - Sub-carrier MER w/marker
  - Delay w/marker
  - Frequency Response w/marker

BER Analysis (Option 0079)

- Layer A, Layer B, Layer C
- BER and Error Count per Layer
  - Before RS
  - Before Viterbi
- PER and Error Count per Layer
- MPEG Bit Rate per Layer
- TMCC Information per Layer
  - Modulation
  - Code Rate
  - Interleave
  - Segments
- Channel Power
- Mode, GI
- Signal Sync Status
- ASI Out

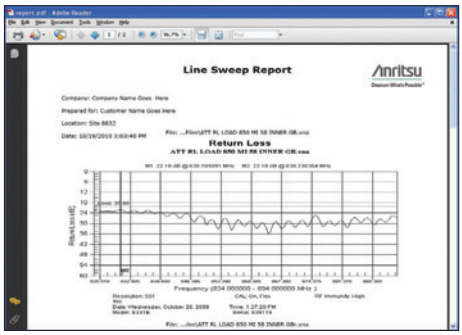
SFN Analysis (Option 0032)

- Impulse Response (w/zoom)
- In-band Spectrum
- Measured Data
  - Channel Power
  - Delay
  - DU Ratio
  - Power
  - Field Strength

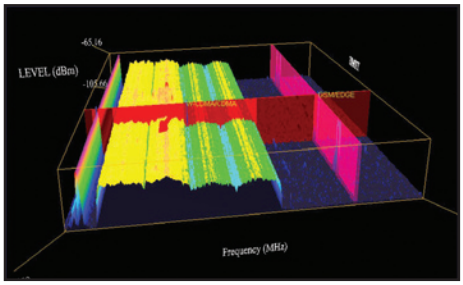
Spectrum Master™ Compact Handheld Spectrum Analyzer Features

Line Sweep Tools and Master Software Tools (for your PC)

Trace Validation
Marker and Limit Line presets allow quick checks of traces for limit violations.



Report Generation
Create reports with company logo, GPS tagging information, calibration status, and serial number of the instrument for complete reporting.



3D Spectrogram
For in-depth analysis with 3-axis rotation viewing, threshold, reference level, and marker control. Turn on Signal ID to see the types of signals.

Line Sweep Tools (available only with PIM Analyzer Option 00419)

Line Sweep Tool increases productivity for people who deal with dozens of Cable and Antenna traces, or Passive Inter-Modulation (PIM) traces, every day.

User Interface

Line Sweep has a user interface that will be familiar to users of Anritsu's Hand Held Software Tools. This will lead to a short learning curve.

Marker and Limit Line Presets

Presets make applying markers and a limit line to similar traces, as well as validating traces, a quick task.

Renaming Grid

A renaming grid makes changing file names, trace titles, and trace subtitles from field values to those required for a report much quicker than manual typing and is less prone to error.

Report Generator

The report generator will generated a professional looking PDF of all open traces with additional information such as contractor logos and contact information.

Master Software Tools

Master Software Tools (MST) is a powerful PC software post-processing tool designed to enhance the productivity of technicians in data analysis and testing automation.

Folder Spectrogram

Folder Spectrogram – creates a composite file of up to 15,000 multiple traces for quick review, also create:

- Peak Power, Total Power, and Peak Frequency plotted over time
- Histogram – filter data and plot number of occurrences over time
- Minimum, Maximum, and Average Power plotted over frequency
- Movie playback – playback data in the familiar frequency domain view
- 3D Spectrogram – for in-depth analysis with 3-axis rotation viewing control

Line Sweep Features

Presets

7 sets of 6 markers and 1 limit line
Next trace capability

File Types

Input: HHST DAT, VNA Measurements: Return Loss (VSWR), Cable Loss, DTF-RL, DTF-VSWR, PIM
Output: LS DAT, VNA, CSV, PNG, BMP, JPG, PDF

Report Generator

Logo, title, company name, customer name, location, date and time, filename, PDF, HTML, all open traces

Tools

Cable Editor
Distance to Fault
Measurement calculator
Signal Standard Editor
Renaming Grid

Interfaces

Serial, Ethernet, USB

Capture Plots to

Screen, Database, DAT files, JPEG, Instrument

Master Software Tools Features

Database Management

Full Trace Retrieval
Trace Catalog
Group Edit
Trace Editor

Data Analysis

Trace Math and Smoothing
Data Converter
Measurement Calculator

Mapping (GPS Required)

Spectrum Analyzer Mode
Mobile WiMAX OTA Option
TS-SCDMA OTA Option
LTE, both FDD and TDD Options

Folder Spectrogram

Folder Spectrogram – 2D View
Video Folder Spectrogram – 2D View
Folder Spectrogram – 3D View

List/Parameter Editors

Traces
Antennas, Cables, Signal Standards
Product Updates
Firmware Upload
Pass/Fail
VSG Pattern Converter
Languages
Mobile WiMAX
Display

Connectivity

Serial, Ethernet, USB
Download measurements and live traces
Upload Lists/Parameters and VSG Patterns
Firmware Updates
Remote Access Tool over the Internet

Spectrum Master™ Ordering Information

Ordering Information – Options

	MS2712E	MS2713E	Description
	9 kHz to 4 GHz	9 kHz to 6 GHz	Spectrum Analyzer
	Options	**Options**	
	MS2712E-0010	MS2713E-0010	Bias-Tee
	MS2712E-0009	MS2713E-0009	20 MHz Bandwidth Demod
	MS2712E-0031	MS2713E-0031	GPS Receiver (requires Antenna)
	MS2712E-0019	MS2713E-0019	High-Accuracy Power Meter (requires External Power Sensor)
	MS2712E-0029	MS2713E-0029	Power Meter
	MS2712E-0025	MS2713E-0025	Interference Analyzer (Option 0031 recommended)
	MS2712E-0027	MS2713E-0027	Channel Scanner
	MS2712E-0431	MS2713E-0431	Coverage Mapping (requires Option 0031)
	MS2712E-0090	MS2713E-0090	Gated Sweep
	MS2712E-0020	MS2713E-0020	Tracking Generator
	MS2712E-0509	MS2713E-0509	AM/FM/PM Analyzer
	MS2712E-0040	MS2713E-0040	GSM/EDGE RF Measurements*
	MS2712E-0041	MS2713E-0041	GSM/EDGE Demodulation*
	MS2712E-0044	MS2713E-0044	W-CDMA/HSPA+ RF Measurements*
	MS2712E-0065	MS2713E-0065	W-CDMA/HSPA+ Demodulation*
	MS2712E-0035	MS2713E-0035	W-CDMA/HSPA+ OTA Measurements*
	MS2712E-0541	MS2713E-0541	LTE RF Measurements*
	MS2712E-0542	MS2713E-0542	LTE Modulation Quality*
	MS2712E-0546	MS2713E-0546	LTE OTA Measurements* (recommend Option 0031)
	MS2712E-0551	MS2713E-0551	TD-LTE RF Measurements*
	MS2712E-0552	MS2713E-0552	TD-LTE Modulation Quality*
	MS2712E-0556	MS2713E-0556	TD-LTE OTA Measurements* (recommend Option 0031)
	MS2712E-0060	MS2713E-0060	TD-SCDMA/HSPA+ Measurements*
	MS2712E-0061	MS2713E-0061	TD-SCDMA/HSPA+ Demodulation*
	MS2712E-0038	MS2713E-0038	TD-SCDMA/HSPA+ OTA Measurements* (recommend Option 0031)
	MS2712E-0042	MS2713E-0042	CDMA RF Measurements*
	MS2712E-0043	MS2713E-0043	CDMA Demodulation*
	MS2712E-0033	MS2713E-0033	CDMA OTA Measurements**
	MS2712E-0062	MS2713E-0062	EV-DO RF Measurements*
	MS2712E-0063	MS2713E-0063	EV-DO Demodulation*
	MS2712E-0034	MS2713E-0034	EV-DO OTA Measurements**
	MS2712E-0046	MS2713E-0046	Fixed WiMAX RF Measurements*
	MS2712E-0047	MS2713E-0047	Fixed WiMAX Demodulation*
	MS2712E-0066	MS2713E-0066	Mobile WiMAX RF Measurements*
	MS2712E-0067	MS2713E-0067	Mobile WiMAX Demodulation*
	MS2712E-0037	MS2713E-0037	Mobile WiMAX OTA Measurements* (recommend Option 0031)
	MS2712E-0030	MS2713E-0030	ISDB-T Digital Video Measurements*
	MS2712E-0032	MS2713E-0032	ISDB-T SFN Measurements*
	MS2712E-0079	MS2713E-0079	ISDB-T BER Measurements (Requires option 0030, cannot be ordered with option 0411)
	MS2712E-0064	MS2713E-0064	DVB-T/H Digital Video Measurements*
	MS2712E-0078	MS2713E-0078	DVB-T/H SFN Measurements*
	MS2712E-0057	MS2713E-0057	DVB-T/H BER Measurements (Requires option 0064, cannot be ordered with option 0411)
	MS2712E-0411	MS2713E-0411	Ethernet Connectivity
	MS2712E-0098	MS2713E-0098	Standard Calibration (ANSI 2540-1-1994)
	MS2712E-0099	MS2713E-0099	Premium Calibration to Z540 plus test data

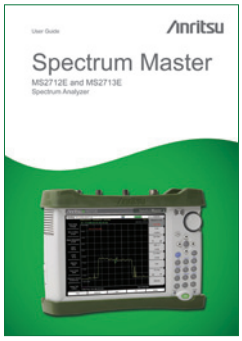
*Requires Option 0009, **Requires Option 0009 and Option 0031

Spectrum Master™ Ordering Information

Power Sensors (For complete ordering information see the respective datasheets of each sensor)

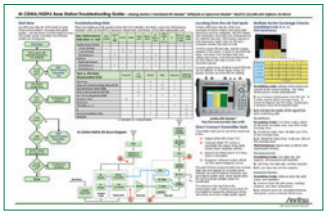
Model Number	Description
PSN50	High Accuracy RF Power Sensor, 50 MHz to 6 GHz, +20 dBm
MA24106A	High Accuracy RF Power Sensor, 50 MHz to 6 GHz, +23 dBm
MA24104A	Inline High Power Sensor, 600 MHz to 4 GHz, +51.76 dBm
MA24105A	Inline Peak Power Sensor, 350 MHz to 4 GHz, +51.76 dBm
MA24108A	Microwave USB Power Sensor, 10 MHz to 8 GHz, +20 dBm
MA24118A	Microwave USB Power Sensor, 10 MHz to 18 GHz, +20 dBm
MA24126A	Microwave USB Power Sensor, 10 MHz to 26 GHz, +20 dBm

Manuals (soft copy included on Handheld Instruments Documentation Disc and at www.anritsu.com)



Part Number	Description
10920-00060	Handheld Instruments Documentation Disc
10580-00251	Spectrum Master User Guide (Hard copy included)
10580-00244	Spectrum Analyzer Measurement Guide - Interference Analyzer, Channel Scanner, Gated Sweep, AM/FM/PM Analyzer, Interference Mapping, Coverage Mapping
10580-00234	3GPP Signal Analyzer Measurement Guide - GSM/EDGE, W-CDMA/HSDPA, TD-SCDMA/HSDPA, LTE
10580-00235	3GPP2 Signal Analyzer Measurement Guide - CDMA, EV-DO
10580-00236	WiMAX Signal Analyzer Measurement Guide - Fixed WiMAX, Mobile WiMAX
10580-00237	Digital TV Measurement Guide - DVB-T/H, ISDB-T
10580-00240	Power Meter Measurement Guide - High Accuracy Power Meter
10580-00256	Programming Manual
10580-00280	PIM Master User Guide

Troubleshooting Guides (soft copy at www.anritsu.com)



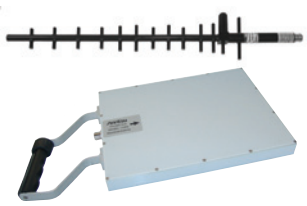
Part Number	Description
11410-00551	Spectrum Analyzers Field User Guide
11410-00472	Interference Troubleshooting Guide
11410-00466	GSM/EDGE Base Stations
11410-00566	LTE eNode Testing
11410-00463	W-CDMA/HSPA+ Base Stations
11410-00465	TD-CDMA/HSPA+ Base Stations
11410-00467	cdmaOne/CDMA2000 1X Base Stations
11410-00468	CDMA2000 1xEV-DO Base Stations
11410-00470	Fixed WiMAX Base Stations
11410-00469	Mobile WiMAX Base Stations

Standard Accessories (included with instrument)

Part Number	Description
10920-00060	Handheld Instruments Documentation Disc
10580-00251	Spectrum Master User Guide (includes Bias-Tee, GPS Receiver)
2000-1654-R	Soft Carrying Case
2300-498	Master Software Tools (MST) CD Disc
2300-530	Anritsu Tool Box with Line Sweep Tools (LST) DVD Disc (For PIM Analyzer Trace Management)
2300-532	Map Master CD
633-44	Rechargeable Li-Ion Battery
40-168-R	AC-DC Adapter
806-141-R	Automotive Cigarette Lighter Adapter
3-2000-1498	USB A/5-pin mini-B Cable, 10 feet/305 cm
11410-00511	Spectrum Master MS2712E, MS2713E Technical Data Sheet One Year Warranty (Including battery, firmware, and software) Certificate of Calibration and Conformance

Spectrum Master™ Optional Accessories

Directional Antennas



Part Number	Description
2000-1411-R	822 MHz to 900 MHz, N(f), 10 dBd, Yagi
2000-1412-R	885 MHz to 975 MHz, N(f), 10 dBd, Yagi
2000-1413-R	1710 MHz to 1880 MHz, N(f), 10 dBd. Yagi
2000-1414-R	1850 MHz to 1990 MHz, N(f), 9.3 dBd, Yagi
2000-1415-R	2400 MHz to 2500 MHz, N(f), 10 dBd, Yagi
2000-1416-R	1920 MHz to 2170 MHz, N(f), 10 dBd, Yagi
2000-1519-R	500 MHz to 3 GHz, log periodic
2000-1677-R	300 MHz to 3 GHz, SMA(m), log periodic
2000-1659-R	698 MHz to 787 MHz, N(f), 8 dBd, Yagi
2000-1660-R	1425 MHz to 1535 MHz, N(f), 12 dBd, Yagi

Portable Antennas

Part Number	Description
2000-1200-R	806 MHz to 866 MHz, SMA(m), 50 Ω
2000-1473-R	870 MHz to 960 MHz, SMA(m), 50 Ω
2000-1035-R	896 MHz to 941 MHz, SMA(m), 50 Ω (1/2 wave)
2000-1030-R	1710 MHz to 1880 MHz, SMA(m), 50 Ω (1/2 wave)
2000-1474-R	1710 MHz to 1880 MHz with knuckle elbow (1/2 wave)
2000-1031-R	1850 MHz to 1990 MHz, SMA(m), 50 Ω (1/2 wave)
2000-1475-R	1920 MHz to 1980 MHz and 2110 MHz to 2170 MHz, SMA(m), 50 Ω
2000-1032-R	2400 MHz to 2500 MHz, SMA(m), 50 Ω (1/2 wave)
2000-1361-R	2400 MHz to 2500 MHz, 5000 MHz to 6000 MHz, SMA(m), 50 Ω
2000-1659-R	698 MHz to 787 MHz, N(f), 8 dBd, Yagi
2000-1660-R	1425 MHz to 1535 MHz, N(f), 12 dBd, Yagi
2000-1636-R	Antenna Kit (Consists of: 2000-1030-R, 2000-1031-R, 2000-1032-R, 2000-1200-R, 2000-1035-R, 2000-1361-R, and carrying pouch)

Mag Mount Broadband Antenna

Part Number	Description
2000-1647-R	Cable 1: 698 MHz to 1200 MHz 2 dBi peak gain, 1700 MHz to 2700 MHz 5 dBi peak gain, N(m), 50 Ω, 10 ft Cable 2: 3000 MHz to 6000 MHz 5 dBi peak gain, N(m), 50 Ω, 10 ft Cable 3: GPS 26 dB gain, SMA(m), 50 Ω, 10 ft
2000-1645-R	694 MHz to 894 MHz 3 dBi peak gain, 1700 MHz to 2700 MHz 3dBi peak gain, N(m), 50 Ω, 10 ft
2000-1646-R	750 MHz to 1250 MHz 3 dBi peak gain, 1650 MHz to 2000 MHz 5 dBi peak gain, 2100 MHz to 2700 MHz 3 dBi peak gain, N(m), 50 Ω, 10 ft
2000-1648-R	1700 MHz to 6000 MHz 3 dBi peak gain,N(m), 50 Ω, 10 ft

Filters

Part Number	Description
1030-114-R	806 MHz to 869 MHz, N(m) to SMA(f), 50 Ω
1030-109-R	824 MHz to 849 MHz, N(m) to SMA(f), 50 Ω
1030-110-R	880 MHz to 915 MHz, N(m) to SMA(f), 50 Ω
1030-105-R	890 MHz to 915 MHz, N(m) to N(f),50 Ω
1030-111-R	1850 MHz to 1910 MHz, N(m) to SMA(f), 50 Ω
1030-106-R	1710 MHz to 1790 MHz N(m) to N(f), 50 Ω
1030-107-R	1910 MHz to 1990 MHz, N(m) to N(f), 50 Ω
1030-112-R	2400 MHz to 2484 MHz, N(m) to SMA(f), 50 Ω
1030-149-R	High Pass, 150 MHz, N(m) to N(f), 50 Ω
1030-150-R	High Pass, 400 MHz, N(m) to N(f), 50 Ω
1030-151-R	High Pass, 700 MHz, N(m) to N(f), 50 Ω
1030-152-R	Low Pass, 200 MHz, N(m) to N(f), 50 Ω
1030-153-R	Low Pass, 550 MHz, N(m) to N(f), 50 Ω
1030-155-R	2500 MHz to 2700 MHz, N(m) to N(f), 50 Ω
1030-178-R	1920 MHz to 1980 MHz, N(m) to N(f), 50 Ω
1030-179-R	777 MHz to 787 MHz, N(m) to N(f), 50 Ω
1030-180-R	2500 MHz to 2570 MHz, N(m) to N(f), 50 Ω
2000-1684-R	791 MHz to 821 MHz, N(m) to N(f), 50 Ω

Spectrum Master™ Optional Accessories

Attenuators

Part Number	Description
3-1010-122	20 dB, 5 W, DC to 12.4 GHz, N(m) to N(f)
42N50-20	20 dB, 5 W, DC to 18 GHz, N(m) to N(f)
42N50A-30	30 dB, 50 W, DC to 18 GHz, N(m) to N(f)
3-1010-123	30 dB, 50 W, DC to 8.5 GHz, N(m) to N(f)
1010-127-R	30 dB, 150 W, DC to 3 GHz, N(m) to N(f)
3-1010-124	40 dB, 100 W, DC to 8.5 GHz, N(m) to N(f), Uni-directional
1010-121	40 dB, 100 W, DC to 18 GHz, N(m) to N(f), Uni-directional
1010-128-R	40 dB, 150 W, DC to 3 GHz, N(m) to N(f)

Phase-Stable Test Port Cables, Armored w/ Reinforced Grip (recommended for cable & antenna line sweep applications)

Part Number	Description
15RNFN50-1.5-R	1.5 m, DC to 6 GHz, N(m) to N(f), 50 Ω
15RDFN50-1.5-R	1.5 m, DC to 6 GHz, N(m) to 7/16 DIN(f), 50 Ω
15RDN50-1.5-R	1.5 m, DC to 6 GHz, N(m) to 7/16 DIN(m), 50 Ω
15RNFN50-3.0-R	3.0 m, DC to 6 GHz, N(m) to N(f), 50 Ω
15RDFN50-3.0-R	3.0 m, DC to 6 GHz, N(m) to 7/16 DIN(f), 50 Ω
15RDN50-3.0-R	3.0 m, DC to 6 GHz, N(m) to 7/16 DIN(m), 50 Ω

Phase-Stable Test Port Cables, Armored (recommended for use with tightly spaced connectors and other general purpose applications)

Part Number	Description
15NNF50-1.5C	1.5 m, DC to 6 GHz, N(m) to N(f), 50 Ω
15NN50-1.5C	1.5 m, DC to 6 GHz, N(m) to N(m), 50 Ω
15NDF50-1.5C	1.5 m, DC to 6 GHz, N(m) to 7/16 DIN(f), 50 Ω
15ND50-1.5C	1.5 m, DC to 6 GHz, N(m) to 7/16 DIN(m), 50 Ω
15NNF50-3.0C	3.0 m, DC to 6 GHz, N(m) to N(f), 50 Ω
15NN50-3.0C	3.0 m, DC to 6 GHz, N(m) to N(m), 50 Ω
15NNF50-5.0C	5.0 m, DC to 6 GHz, N(m) to N(f), 50 Ω
15NN50-5.0C	5.0 m, DC to 6 GHz, N(m) to N(m), 50 Ω

Adapters

Part Number	Description
1091-26-R	SMA(m) to N(m), DC to 18 GHz, 50 Ω
1091-27-R	SMA(f) to N(m), DC to 18 GHz, 50 Ω
1091-80-R	SMA(m) to N(f), DC to 18 GHz, 50 Ω
1091-81-R	SMA(f) to N(f), DC to 18 GHz, 50 Ω
1091-172-R	BNC(f) to N(m), DC to 1.3 GHz, 50 Ω
510-102-R	N(m) to N(m), DC to 11 GHz, 50 Ω, 90 degrees right angle

Precision Adapters

Part Number	Description
34NN50A	Precision Adapter, N(m) to N(m), DC to 18 GHz, 50 Ω
34NFNF50	Precision Adapter, N(f) to N(f), DC to 18 GHz, 50 Ω

Spectrum Master™ Optional Accessories

Backpack and Transit Case

Part Number	Description
67135	Anritsu Backpack (For Handheld Instrument and PC)
760-243-R	Large Transit Case with Wheels and Handle

Miscellaneous Accessories

Part Number	Description
2000-1528-R	GPS Antenna, SMA(m) with 15 ft cable
2000-1652-R	GPS Antenna, SMA(m) with 1 ft cable
806-245-R	Calibration Accessory for use with Option 20 Tracking Generator
2000-1374	External Charger for Li-Ion Batteries
2000-1371-R	Ethernet Cable, 7 ft/213 cm
2000-1689	EMI Near Field Probe Kit
3-806-152	Cat 5e Crossover Patch Cable, 7 ft/213 cm)
2300-517	Phase Noise Measurement Software (requires Ethernet Option 0411)
633-75	8000 mAh High-capacity Battery Pack
2000-1653	Anti-glare Screen Cover (package of 2)

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11410-00518, Rev. E Printed in United States 2012-05
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Technical Data Sheet

Spectrum Master™
Compact Handheld Spectrum Analyzer

MS2712E 9 kHz to 4 GHz

MS2713E 9 kHz to 6 GHz

Introduction

Anritsu introduces its next generation compact handheld Spectrum Analyzers to meet the needs for portability. Whether it is for spectrum monitoring, broadcast proofing, interference analysis, RF and microwave measurements, or Wi-Fi and wireless network measurements, the Spectrum Master is the ideal instrument for making fast and reliable measurements.

Spectrum Analyzer Highlights

- Measurements: Occupied Bandwidth, Channel Power, ACPR, C/I
- Interference Analyzer: Spectrogram, Signal Strength, RSSI, Mapping
- Dynamic Range: > 102 dB in 1 Hz RBW
- DANL: –162 dBm in 1 Hz RBW
- Phase Noise: –100 dBc/Hz max @ 10 kHz offset at 1 GHz
- Frequency Accuracy: < ± 50 ppb with GPS On
- Traces: Normal, Max Hold, Min Hold, Average, # of Averages
- Detectors: Peak, Negative, Sample, Quasi-peak, and true RMS
- Markers: 6, each with a Delta Marker, or 1 Reference with 6 Deltas
- Limit Lines: up to 41 segments with one-button envelope creation
- Trace Save-on-Event: crossing limit line or sweep complete

Capabilities and Functional Highlights

- LTE, TD-LTE (20 MHz B/W)
- CDMA, EV-DO
- GSM/EDGE
- W-CDMA/HSPA+
- TD-SCDMA/HSPA+
- Fixed, Mobile WiMAX
- ISDB-T, ISDB-T SFN
- DVB-T/H, DVB-T/H SFN
- PIM Analyzer
- Gated Sweep
- Tracking Generator
- Internal Preamplifier standard
- Internal Bias-Tee
- Internal Power Meter
- High Accuracy Power Meter
- 4, 6, 8, 18, 26 GHz Power Sensors
- GPS tagging of saved traces
- Channel Scanner
- < 5 minute warm-up time
- 3 hour battery operation time
- New Fast Sweep Speed Mode
- On-Screen Coverage Mapping
- Touchscreen keyboard
- USB & Optional Ethernet (Option 0411) for data transfer and instrument control
- Increase throughput by automating repetitive or operator intensive tasks via Ethernet or USB. Remote programming provided via Ethernet (Option 0411).
- Master Software Tools
- Line Sweep Tools

Spectrum Master™ MS2712E Spectrum Analyzer featuring 8.4” Daylight Viewable Touchscreen
Compact Size: 273 mm x 199 mm x 91 mm, (10.7 in x 7.8 in x 3.6 in), Lightweight: 3.45 kg, (7.6 lbs)

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Spectrum Master™ MS2712E and MS2713E Specifications

Spectrum Analyzer

Measurements	
Smart Measurements	Field Strength (uses antenna calibration tables to measure dBm/m², dBmV/m, dBV/m, dBu/m, Volt/m, Watt/m², dBW/m², A/m dBA/m and Watt/cm²)
	Occupied Bandwidth (measures 99% to 1% power channel of a signal)
	Channel Power (measures the total power in a specified bandwidth)
	ACPR (adjacent channel power ratio)
	AM/FM/SSB Demodulation (wide/narrow FM, USB and LSB), (audio out only)
	C/I (carrier-to-interference ratio)
	Emission Mask
	Coverage Mapping (requires Option 0431)
Setup Parameters	
Frequency	Center/Start/Stop, Span, Frequency Step, Signal Standard, Channel #, Channel Increment
Amplitude	Reference Level (RL), Scale, Attenuation Auto/Level, RL Offset, Pre-Amp On/Off, Detection
Span	Span, Span Up/Down (1-2-5), Full Span, Zero Span, Last Span
Bandwidth	RBW, Auto RBW, VBW, Auto VBW, RBW/VBW, Span/RBW
File	Save, Recall, Delete, Directory Management
Save/Recall	Setups, Measurements, Limit Lines, Screen Shots Jpeg (save only), Save-on-Event
Save-on-Event	Crossing Limit Line, Sweep Complete, Save-then-Stop, Clear All
Delete	Selected File, All Measurements, All Mode Files, All Content
Directory Management	Sort Method (Name/Type/Date), Ascend/Descend, Internal/USB, Copy, Format USB
Application Options	Bias-Tee (On/Off), Impedance (50 Ω, 75 Ω, Other)
Sweep Functions	
Sweep	Single/Continuous, Sweep Mode (Fast, Performance, No FFT), Reset, Detection, Minimum Sweep Time, Trigger Type, Gated Sweep (see Option 0090)
Detection	Peak, RMS, Negative, Sample, Quasi-peak
Triggers	Free Run, External, Video, Change Position, Manual
Trace Functions	
Traces	Up to three Traces (A, B, C), View/Blank, Write/Hold, Trace A/B/C Operations
Trace A Operations	Normal, Max Hold, Min Hold, Average, # of Averages, (always the live trace)
Trace B Operations	A → B, B←→C, Max Hold, Min Hold
Trace C Operations	A → C, B←→C, Max Hold, Min Hold, A - B → C, B - A → C, Relative Reference (dB), Scale
Marker Functions	
Markers	Markers 1-6 each with a Delta Marker, or Marker 1 Reference with Six Delta Markers, Marker Table (On/Off), All Markers Off,
Marker Types	Style (Fixed/Tracking), Noise Marker, Frequency Counter Marker
Marker Auto-Position	Peak Search, Next Peak (Right/Left), Peak Threshold %, Set Marker to Channel, Marker Frequency to Center, Delta Marker to Span, Marker to Reference Level
Marker Table	1-6 markers frequency and amplitude plus delta markers frequency amplitude and offset
Limit Line Functions	
Limit Lines	Upper/Lower, On/Off, Edit, Move, Envelope, Advanced, Limit Alarm, Default Limit
Limit Line Edit	Frequency, Amplitude, Add Point, Add Vertical, Delete Point, Next Point Left/Right
Limit Line Move	To Current Center Frequency, By dB or Hz, To Marker 1, Offset from Marker 1
Limit Line Envelope	Create Envelope, Update Amplitude, Points (41 max), Offset, Shape Square/Slope
Limit Line Advanced	Type (Absolute/Relative), Mirror, Save/Recall
Frequency	
Frequency Range	9 kHz to 4 GHz (MS2712E), 9 kHz to 6 GHz (MS2713E) (usable to 0 Hz)
Tuning Resolution	1 Hz
Frequency Reference	Aging: ± 1.0 ppm/year Accuracy: ± 1.5 ppm (25 °C ± 25 °C) + aging, < ± 50 ppb with GPS On
Frequency Span	10 Hz to 4 GHz including zero span (MS2712E), 10 Hz to 6 GHz including zero span (MS2713E)
Sweep Time	Minimum 100 ms, 10 µs to 600 seconds in zero span
Sweep Time Accuracy	± 2 % in zero span
Bandwidth	
Resolution Bandwidth (RBW)	1 Hz to 3 MHz in 1–3 sequence ± 10% (1 MHz max in zero-span) (–3 dB bandwidth)
Video Bandwidth (VBW)	1 Hz to 3 MHz in 1–3 sequence (–3 dB bandwidth) (auto or manually selectable)
RBW with Quasi-Peak Detection	200 Hz, 9 KHz, 120 kHz (–6 dB bandwidth)
VBW with Quasi-Peak Detection	Auto VBW is On, RBW/VBW = 1

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Spectrum Master™ MS2712E and MS2713E Specifications

Spectrum Analyzer (continued)

Spectral Purity

SSB Phase Noise @ 1 GHz	–100 dBc/Hz, –110 dBc/Hz typical @ 10 kHz offset
	–105 dBc/Hz, –112 dBc/Hz typical @ 100 kHz offset
	–115 dBc/Hz, –121 dBc/Hz typical @ 1 MHz offset

Amplitude Ranges

Dynamic Range	> 102 dB (2.4 GHz), 2/3 (TOI-DANL) in 1 Hz RBW
Measurement Range	DANL to +26 dBm
Display Range	1 dB to 15 dB/div in 1 dB steps, ten divisions displayed
Reference Level Range	–120 dBm to +30 dBm
Attenuator Range	0 dB to 55 dB in 5 dB steps
Maximum Continuous Input	+30 dBm
Amplitude Units	Log Scale Modes: dBm, dBV, dBmV, dBuV, dBW, dBmW, dBuW, dBA, dBmA,dBuA Linear Scale Modes: nV,uV,mV,V,kV,nW,uW,mW,W,kW,nA,uA,mA,A

Amplitude Accuracy

9 kHz to 100 kHz	± 2.0 dB typical
100 kHz to 4.0 GHz	± 1.25 dB, ± 0.5 dB typical
> 4.0 GHz to 6 GHz	± 1.50 dB, ± 0.5 dB typical

Displayed Average Noise Level (DANL)

	Preamp Off (Reference level –20 dBm)		Preamp On (Reference level –50 dBm)	
(RBW = 1 Hz, 0 dB attenuation)	Maximum	Typical	Maximum	Typical
10 MHz to 2.4 GHz	–141 dBm	–146 dBm	–157 dBm	–162 dBm
> 2.4 GHz to 4 GHz	–137 dBm	–141 dBm	–154 dBm	–159 dBm
> 4 GHz to 5 GHz	–134 dBm	–138 dBm	–150 dBm	–155 dBm
> 5 GHz to 6 GHz	–126 dBm	–131 dBm	–143 dBm	–150 dBm

Spurs

Residual Spurious	< –90 dBm (RF input terminated, 0 dB input attenuation, > 10 MHz)
Input-Related Spurious	< –75 dBc (0 dB attenuation, –30 dBm input, span < 1.7 GHz, carrier offset > 4.5 MHz)
Exceptions, typical	< –70 dBc @ <2.5 GHz, with 2072.5 MHz Input
	< –68 dBc @ F1 - 280 MHz with F1 Input
	< –70 dBc @ F1 + 190.5 MHz with F1 Input
	< –52 dBc @ 7349 - (2F2) MHz, with F2 Input, where F2 < 2424.5 MHz
	< –55 dBc @ 190.5 ± (F1/2) MHz, F1 < 1 GHz

Third-Order Intercept (TOI)

	Preamp Off (–20 dBm tones 100 kHz apart, 10 dB attenuation)
800 MHz	+16 dBm
2400 MHz	+20 dBm
200-2200 MHz	+25 dBm, typical
> 2.2 GHz to 5.0 GHz	+28 dBm, typical
> 5.0 GHz to 6.0 GHz	+33 dBm, typical

Second Harmonic Distortion

	Preamp Off, 0 dB input attenuation, –30 dBm input
50 MHz	–56 dBc
> 50 MHz to 200 MHz	–60 dBc, typical
> 200 MHz to 3000 MHz	–70 dBc, typical

VSWR

2:1, typical

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Spectrum Master™ MS2712E and MS2713E Specifications

PIM Analyzer (Requires PIM Master™)

See Product Brochure 11410-00546

Bias-Tee (Option 0010)

Setup	On/Off, Voltage, Current (Low/High)
Voltage Range	+12 V to +32 V
Current (Low/High)	250 mA/450 mA, 1 A surge for 100 ms
Resolution	0.1 V

Coverage Mapping (Options 0431)

Measurements

Indoor Mapping	Outdoor Mapping
RSSI	RSSI
ACPR	ACPR

Setup Parameters

Frequency	Center/Start/Stop, Span, Freq Step, Signal Standard, Channel #, Channel Increment
Amplitude	Reference Level (RL), Scale, Attenuation Auto/Level, RL Offset, Pre-Amp On/Off, Detection
Span	Span, Span Up/Down (1-2-5), Full Span, Zero Span, Last Span
BW	RBW, Auto RBW, VBW, Auto VBW, RBW/VBW, Span/VBW
Measurement Setup	ACPR, RSSI
Point Distance / Time Setup	Repeat Type Time Distance
Save Points Map	Save KML, JPEG, Tab Delimited
Recall Points Map	Recall Map, Recall KML Points only, Recall KML Points with Map, Recall Default Grid

Ethernet Connectivity (Option 0411)

Connector	RJ45
LAN Speed	10 Mbps
Mode	Static, DHCP
Static IP settings	IP address Subnet Mask IP Gateway
Remote Control	Remote Access utility provided with Master Software Tools
Data Upload	With Line Sweep Tools through LAN connection

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Spectrum Master™ MS2712E and MS2713E Specifications

Interference Analyzer (Option 0025)

Measurements	Spectrum
	Field Strength
	Occupied Bandwidth
	Channel Power
	Adjacent Channel Power (ACPR)
	AM/FM/SSB Demodulation (Wide/Narrow FM, Upper/Lower SSB), (audio out only)
	Carrier-to-Interference ratio (C/I)
	Spectrogram (Collect data up to one week)
	Signal Strength (Gives visual and aural indication of signal strength)
	Received Signal Strength Indicator (RSSI) (collect data up to one week)
	Gives visual and aural indication of signal strength
	Signal ID (up to 12 signals)
	Center Frequency
	Bandwidth
	Signal Type (FM, GSM, W-CDMA, CDMA, Wi-Fi)
	Closest Channel Number
	Number of Carriers
	Signal-to-Nose Ratio (SNR) > 10 dB
	Interference Mapping
	Triangulate location of interference with on display maps
Application Options	Bias-Tee (On/Off), Impedance (50 Ω, 75 Ω, Other)

GPS Receiver Option (Option 0031) (Antenna sold separately)

Setup	On/Off, Antenna Voltage 3.3/5.0 V, GPS Info
GPS Time/Location Indicator	Time, Latitude, Longitude and Altitude on display Time, Latitude, Longitude and Altitude with trace storage
High Frequency Accuracy	Spectrum Analyzer, Interference Analyzer, CW Signal Analyzers
when GPS Antenna is connected	< ± 50 ppb with GPS On, 3 minutes after satellite lock in selected mode
Connector	SMA, Female

Tracking Generator Option (Option 0020)

Setup Parameters

Measure Set-up	Off/On, Output Power, Reset Sweep, Insertion Loss, Abs Max, Min, Avg (On/Off)
Insertion Loss Set-up	Normalize (Off/On), Rel Reference, Rel Scale, Transmission, Min, Avg (Off, On) RL Offset
Frequency Range	500 kHz to 4.0 GHz (MS2712E), 500 kHz to 6.0 GHz (MS2713E)
Output Power Range	–50 to 0 dBm
Step Size	0.1 dB nominal
Output Flatness	± 1.0 dB max, ± 0.3 dB typical*
Zero Span Behavior	CW Output
Output Connector	Type N female, 50 Ω
Damage Level	+ 23 dBm ± 50 VDC (limited dv/dt)

* Using field calibration, relative to spectrum analyzer input with ≥ 3 dB attenuator

Spectrum Master™ MS2712E and MS2713E Specifications

Channel Scanner (Option 0027)

Number of Channels	1 to 20 Channels
Measurements	Graph/Table, Max Hold (On/5 sec/Off), Freq/Channel, Current/Max, Single/Dual Color
Scanner	Scan Channels, Scan Frequencies, Scan Customer List, Scan Script Master™
Amplitude	Reference Level, Scale
Custom Scan	Signal Standard, Channel, # of Channels, Channel Step Size, Custom Scan
Frequency Range	100 kHz to 4 GHz (MS2712E), 100 kHz to 6 GHz (MS2713E)
Frequency Accuracy	± 10 Hz + Time base error
Measurement Range	–110 dBm to +26 dBm
Application Options	Bias-Tee (On/Off), Impedance (50 Ω, 75 Ω, Other)

Gated Sweep (Option 0090)

Mode	Spectrum Analyzer, Sweep
Trigger	External TTL
Setup	Gated Sweep (On/Off)
	Gate Polarity (Rising, Falling)
	Gate Delay (0 ms to 65 ms typical)
	Gate Length (1 µs to 65 ms typical)
	Zero Span Time

20 MHz BW Demod (Option 0009)

	Required for all signal analyzers except AM/FM/PM Signal Analyzer, Option 509

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Spectrum Master™ MS2712E and MS2713E Specifications

Power Meter (Option 0029)

Frequency	Center/Start/Stop, Span, Frequency Step, Signal Standard, Channel #, Full Band
Amplitude	Maximum, Minimum, Offset, Relative On/Off, Units, Auto Scale
Average	Acquisition Fast/Med/Slow, # of Running Averages
Limits	Limit On/Off, Limit Upper/Lower
Frequency Range	10 MHz to 4 GHz (MS2712E), 10 MHz to 6 GHz (MS2713E)
Span	1 kHz to 100 MHz
Display Range	–140 dBm to +30 dBm, ≤ 40 dB span
Measurement Range	–120 dBm to +26 dBm
Offset Range	0 dB to +100 dB
VSWR	2:1 typical
Maximum Power	+30 dBm without attenuator
Accuracy	Same as Spectrum Analyzer
Application Options	Impedance (50 Ω, 75 Ω, Other)

High Accuracy Power Meter (Option 0019) (Requires external USB Power Sensor(s))

Amplitude	Maximum, Minimum, Offset, Relative On/Off, Units, Auto Scale
Average	# of Running Averages, Max Hold
Zero/Cal	Zero On/Off, Cal Factor (Center Frequency, Signal Standard)
Limits	Limit On/Off, Limit Upper/Lower

Power Sensor Model	**PSN50**	**MA24104A/05A**	**MA24106A**	**MA24108A/18A/26A**
Description	High Accuracy RF Power Sensor	Inline High Power Sensor	High Accuracy RF Power Sensor	Microwave USB Power Sensor
Frequency Range	50 MHz to 6 GHz	600 MHz to 4 GHz (**MA24104A**) 350 MHz to 4 GHz (**MA24105A**)	50 MHz to 6 GHz	10 MHz to 8 GHz (**MA24108A**) 10 MHz to 18 GHz (**MA24118A**) 10 MHz to 26 GHz (**MA24126A**)
Connector	Type N(m), 50 Ω	Type N(f), 50 Ω (**MA24104A**) Type N(f), 50 Ω (**MA24105A**)	Type N(m), 50 Ω	Type N(m), 50 Ω (**MA24108A/18A**) Type K(m), 50 Ω (**MA24126A**)
Dynamic Range	–30 dBm to +20 dBm (.001 mW to 100 mW)	+3 dBm to +51.76 dBm (2 mW to 150 W)	–40 dBm to +23 dBm (0.1 µW to 200 mW)	–40 dBm to +20 dBm (0.1 µW to 100 mW)
VBW	100 Hz	100 Hz	100 Hz	50 kHz
Measurand	True-RMS	True-RMS	True-RMS	True-RMS, Slot Power, Burst Average Power
Measurement Uncertainty	± 0.16 dB[1]	± 0.17 dB[2]	± 0.16 dB[1]	± 0.18 dB[3]
Datasheet (for complete specifications)	11410-00414	11410-00483 (**MA24104A**) 11410-00621 (**MA24105A**)	11410-00424	11410-00504

Notes:
1) Total RSS measurement uncertainty (0 ºC to 50 ºC) for power measurements of a CW signal greater than –20 dBm with zero mismatch errors.
2) Expanded uncertainty with K=2 for power measurements of a CW signal greater than +20 dBm with a matched load. Measurement results referenced to the input side of the sensor.
3) Expanded uncertainty with K=2 for power measurements of a CW signal greater than –20 dBm with zero mismatch errors.

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Spectrum Master™ MS2712E and MS2713E Specifications

LTE Signal Analyzers (Options 0541, 0542, 0546, 0551, 0552, 0556)

Measurements

RF (Option 0541 FDD) (Option 0551 TDD)	Modulation (Option 0542 FDD) (Option 0552 TDD)	Over-the-Air (OTA) (Option 0546 FDD) (Option 0556 TDD)	Pass/Fail (User Editable)
Channel Spectrum Channel Power Occupied Bandwidth Power vs. Time (TDD only) Frame View Sub-Frame View Total Frame Power DwPTS Power Transmit Off Power Cell ID Timing Error ACPR Spectral Emission Mask Category A or B (Opt 1) RF Summary	Power vs. Resource Block (RB) RB Power (PDSCH) Active RBs, Utilization % Channel Power, Cell ID OSTP, Frame EVM by modulation (FDD only) Constellation QPSK, 16 QAM, 64 QAM Modulation Results Ref Signal Power (RS) Sync Signal Power (SS) EVM – rms, peak, max hold Frequency Error – Hz, ppm Carrier Frequency Cell ID Control Channel Power Bar Graph or Table View RS, P-SS, S-SS PBCH, PCFICH, PHICH, PDCCH Total Power (Table View) EVM Modulation Results Tx Time Alignment Modulation Summary Includes EVM by modulation (FDD only) Antenna Icons Detects active antennas (1/2)	Scanner Cell ID (Group, Sector) S-SS Power, RSRP, RSRQ, SINR Dominance Modulation Results – On/Off Tx Test Scanner RS Power of MIMO antennas Cell ID, Average Power Delta Power (Max-Min) Graph of Antenna Power Modulation Results – On/Off Mapping On-screen S-SS Power, RSRP, RSRQ, or SINR Scanner Modulation Results – Off	View Pass/Fail Limits All, RF, Modulation Available Measurements Channel Power Occupied Bandwidth ACLR Frequency Error Carrier Frequency Dominance EVM peak, rms RS Power RS EVM (FDD only) SS, P-SS, S-SS Power SS, P-SS, S-SS EVM (FDD only) PBCH Power PBCH EVM (FDD only) PCFICH Power PCFICH EVM (FDD only) PHICH Power, EVM (FDD only) PDCCH Power, EVM (FDD only) Cell, Group, Sector ID OSTP (FDD only) Tx Time Alignment (FDD only) Frame Power (TDD only) DWPTS Power (TDD only) Transmit Off Power (TDD only) Timing Error (TDD only)

Setup Parameters

Frequency	E-UTRA FDD bands 1 - 5, 7 - 14, 17 - 21, 23 - 25 (tunable 10 MHz to 4.0 GHz) E-UTRA TDD bands 33 - 43 (tunable 10 MHz to 4.0 GHz) Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
Bandwidth	1.4, 3, 5, 10, 15, 20 MHz
Span	Auto, 1.4, 3, 5, 10, 15, 20, 30 MHz
Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range
Sweep	Single/Continuous, Trigger Sweep
EVM Mode	Auto, PBCH only
Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality Measurements

RF Measurements (Options 0541, 0551)

RF Channel Power Accuracy	± 1.5 dB, ± 1.0 dB typical, (RF input –50 dBm to +10 dBm) (Option 0541) ± 1.5 dB, ± 1.0 dB typical, (RF input –30 dBm to +10 dBm) (Option 0551)

Modulation Measurements (Options 0542, 0552)

Frequency Error	± 10 Hz + time base error, 99% confidence level
Residual EVM (rms) (FDD only)	2.0% typical (E-UTRA Test Model 3.1, RF Input –50 dBm to +10 dBm) for BW ≤ 10 MHz 2.5% typical (E-UTRA Test Model 3.1, RF Input –50 dBm to +10 dBm) for BW > 10 MHz
Residual EVM (rms) (TDD only)	2.0% typical (E-UTRA Test Model 3.1, RF Input –30 dBm to +10 dBm) for BW ≤ 10 MHz 2.5% typical (E-UTRA Test Model 3.1, RF Input –30 dBm to +10 dBm) for BW > 10 MHz

Over-the-Air (OTA) Measurements (Options 0546, 0556)

Scanner	Six strongest signals if present Auto Save – Sync Signal Power and Modulation Results with GPS tagging
Auto Save	Scanner – three strongest signals if present RS Power – strongest signal
Mapping	Map On-screen S-SS Power, RSRP, RSRQ, or SINR of Cell ID with strongest signal Scanner – three strongest signals if present Save and Export Scanner data: *.kml, *.mtd (tab delimited)

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Spectrum Master™ MS2712E and MS2713E Specifications

TD-SCDMA/HSPA+ Signal Analyzers (Options 0060, 0061, 0038)

Measurements

RF (Option 0060)	Demodulation (Option 0061)	Over-the-Air (OTA) (Option 0038)	Pass/Fail (User Editable)
Channel Spectrum Channel Power Occupied Bandwidth Left Channel Power Left Channel Occ B/W Right Channel Power Right Channel Occ B/W Power vs. Time Six Slot Powers Channel Power (RRC) DL-UL Delta Power UpPTS Power DwPTS Power On/Off Ratio Slot Peak-to-Average Power Spectral Emission RF Summary	Code Domain Power/Error (QPSK/8 PSK/16 QAM) Slot Power DwPTS Power Noise Floor Frequency Error Tau Scrambling Code EVM Peak EVM Peak Code Domain Error Modulation Summary	Code Scan (32) Scrambling Code Group Tau E_c/I_o Pilot Dominance Tau Scan (Six) Sync-DL# Tau E_c/I_o DwPTS Power Pilot Dominance	Occupied Bandwidth Channel Power Channel Power RCC On/Off Ratio Peak-to-Average Ratio Frequency Error EVM Peak EVM Peak Code Domain Error Tau Noise Floor

Setup Parameters

Slot Selection	Auto, 0-6
Trigger	Trigger Type (No Trigger/GPS/External), External Trigger (Rising/Falling), Tau Offset
SYNC-DL Code	Auto, 0-31
Scrambling/Midamble Code	Auto, 0-127
Maximum Users	Auto, 2, 4, 6, 8, 10, 12, 14, 16
Measurement Speed	Fast, Normal, Slow
User Selectable	Uplink Switch Point, Number of Carriers (1, 3), Tau Offset
Demodulation Type	Auto, QPSK, 8 PSK, 16 QAM
Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range, Units (dBm/Watts)
Sweep	Hold/Run, Trigger Sweep
Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality Measurements

RF Measurements (Option 0060) (temperature range 15 ºC to 35 ºC)

RF Channel Power Accuracy (RRC)	± 1.5 dB, ±1.0 dB typical, (slot power –40 dBm to +10 dBm)
Frequency Error	± 10 Hz + time base error, in the presence of a downlink slot

Demodulation (Option 0061) (temperature range 15 ºC to 35 ºC)

Supported Modulation	QPSK, 8 PSK, 16 QAM
Residual EVM (rms)	3% typical, P-CCPH slot power > –50 dBm
PN Offset	Within 1 x 64 chips
Pilot Power Accuracy	± 1.0 dB typical
Timing Error (Tau) for Dominant SYNC-DL	± 0.2 µs (external trigger)
Spreading Factor	1, 16

Over-the-Air (OTA) Measurements (Option 0038)

Code Scanner	32 Sync Codes and associated Scrambling Code Groups
Tau Scanner	Six strongest Sync Codes
Auto Save	Yes
GPS Logging	Yes

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Spectrum Master™ MS2712E and MS2713E Specifications

GSM/EDGE Signal Analyzers (Options 0040, 0041)

Measurements

RF (Option 0040)	Demodulation (Option 0041)	Over-the-Air (OTA)	Pass/Fail (User Editable)
Channel Spectrum Channel Power Occupied Bandwidth Burst Power Average Burst Power Frequency Error Modulation Type BSIC (NCC, BCC) Multi-channel Spectrum Power vs. Time (Frame/Slot) Channel Power Occupied Bandwidth Burst Power Average Burst Power Frequency Error Modulation Type BSIC (NCC, BCC)	Phase Error EVM Origin Offset C/I Modulation Type Magnitude Error BSIC (NCC, BCC)	There are no additional OTA Measurements. RF Measurements and Demodulation can be made OTA	Channel Power Occupied Bandwidth Burst Power Average Burst power Frequency Error Phase Error EVM Origin Offset C/I Magnitude Error

Setup Parameters

GSM/EDGE Select	Auto, GSM, EDGE
Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
Amplitude	Power Offset, Auto Range, Adjust Range
Sweep	Single/Continuous, Trigger Sweep
Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality Measurements

RF Measurements (Option 0040) (temperature range 15 ºC to 35 ºC)

Frequency Error	± 10 Hz + time base error, 99% confidence level
Occupied Bandwidth	Bandwidth within which 99% of the power transmitted on a single channel lies
Burst Power Error	± 1.5 dB, ± 1 dB typical, (–50 dBm to +20 dBm)

Demodulation (Option 0041) (temperature range 15 ºC to 35 ºC)

GSMK Modulation Quality (RMS Phase) Measurement Accuracy	± 1 deg
Residual Error (GSMK)	1 deg
8 PSK Modulation Quality (EVM) Measurement Accuracy	± 1.5%
Residual Error (8 PSK)	2.5%

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Spectrum Master™ MS2712E and MS2713E Specifications

W-CDMA/HSPA+ Signal Analyzers (Options 0044, 0065, 0035)

Measurements

RF (Option 0044)	Demodulation (Option 0065)	Over-the-Air (OTA) (Option 0035)	Pass/Fail (User Editable)

Band Spectrum
Channel Spectrum
  Channel Power
  Occupied Bandwidth
  Peak-to-Average Power
Spectral Emission Mask
Single carrier ACLR
Multi-carrier ACLR
RF Summary
	Code Domain Power Graph
	  P-CPICH Power
	  Channel Power
	  Noise Floor
	  EVM
	  Carrier Feed Through
	  Peak Code Domain Error
	  Carrier Frequency
	  Frequency Error
	  Control Channel Power
	  Abs/Rel/Delta Power
	  CPICH, P-CCPCH
	  S-CCPCH, PICH
	  P-SCH, S-SCH
	  HSPA+
	  Power vs. Time
	  Constellation
	Code Domain Power Table
	  Code, Status
	  EVM, Modulation Type
	  Power, Code Utilization
	  Power Amplifier Capacity
	Codogram
	Modulation Summary
		Scrambling Code Scanner (Six)
		  Scrambling Codes
		  CPICH
		  E_c/I_o
		  E_c
		  Pilot Dominance
		  OTA Total Power
		Multipath Scanner (Six)
		  Six Multipaths
		  Tau
		  Distance
		  RSCP
		  Relative Power
		  Multipath Power
			Max Output Power
			Frequency Error
			EVM
			CPICH
			Occupied Bandwidth
			Spectral Mask
			ACLR
			PCDE
			P-CCPCH
			S-CCPCH
			Code Spread 3
			PICH
			Code 128
			
			Test Models
			  1 (16), (32), (64)
			  2
			  3 (16), (32)
			  4 (+CPICH), (–CIPCH)
			  5 (2 HS), (4 HS), (8 HS)

Setup Parameters

Scrambling Code, Threshold	Auto, Manual
User Selectable	Scrambling Code, S-CCPCH Spread, S-CCPCH Code, PICH Code, Threshold, Max Amp Power, CPICH Power, Frequency Error Average
Maximum Spreading Factor	256, 512
Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range, Units (dBm/Watts)
Marker	Six Markers, Table On/Off
Sweep	Single/Continuous, Trigger Sweep
Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality Measurements

RF Measurements (Option 0044) (temperature range 15 ºC to 35 ºC)

Frequency Range	Bands I – XIV, XVII
RF Channel Power Accuracy	± 1.25 dB, ± 0.7 dB typical, (temperature range 15 ºC to 35 ºC)
Occupied Bandwidth Accuracy	± 100 kHz
Adjacent Channel Leakage Ratio (ACLR)	–54 dB/–59 dB ± 0.8 dB @ 5 MHz/10 MHz offset, typical, Bands I – VI, VIII – XIV, XVII –54 dB/–57 dB ± 1.0 dB @ 5 MHz/10 MHz offset, typical, Band VII

Demodulation (Option 0065)

W-CDMA Modulations	QPSK, QPSK-DTX (Codecs: AMR 4.75, 5.9, 7.4, 12.2 kbps, DTX 7.4, 12,2 kbps)
HSPA+ Modulations	QPSK, 16 QAM, 64 QAM
EVM Accuracy	± 2.5 %, 6% ≤ EVM ≤ 25%
Residual EVM	3.25% typical
Code Domain Power	± 0.5 dB for code channel power > –25 dB, 16, 32, 64 DCPH (test model 1), 16, 32 DCPH (test model 2, 3)
CPICH (dBm) Accuracy	± 0.8 dB typical

Over-the-Air (OTA) Measurements (Option 0035)

Scrambling Code Scanner	Six strongest Scrambling Codes
Multipath Scanner	Six multipaths' power relative to strongest pilot

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Spectrum Master™ MS2712E and MS2713E Specifications

CDMA Signal Analyzers (Option 0042, 0043, 0033)

Measurements

RF (Option 0042)	Demodulation (Option 0043)	Over-the-Air (OTA) (0ption 0033)	Pass/Fail (User Editable)
Channel Spectrum Channel Power Occupied Bandwidth Peak-to-Average Power Spectral Emission Mask Multi-carrier ACPR RF Summary	Code Domain Power Graph Pilot Power Channel Power Noise Floor Rho Carrier Feed Through Tau RMS Phase Error Frequency Error Abs/Rel/ Power Pilot Page Sync Q Page Code Domain Power Table Code Status Power Multiple Codes Code Utilization Modulation Summary	Pilot Scanner (Nine) PN E_c/I_o Tau Pilot Power Channel Power Pilot Dominance Multipath Scanner (Six) E_c/I_o Tau Channel Power Multipath Power Limit Test – 10 Tests Averaged Rho Adjusted Rho Multipath Pilot Dominance Pilot Power Pass/Fail Status	Channel Power Occupied Bandwidth Peak-to-Average Power Spectral Mask Test Frequency Error Channel Frequency Frequency error Pilot Power Noise Floor Rho Carrier Feed Through Tau RMS Phase Error Code Utilization Measured PN Pilot Dominance Multipath Power

Setup Parameters

PN Setup	PN Trigger (No Trigger, GPS, External), PN Search Type (Auto, Manual), PN Offset
Walsh Codes	64, 128
Measurement Speed	Fast, Normal, Slow
External Trigger Polarity	Rising, Falling
Number of Carriers	1 to 5
Carrier Bandwidth	1.23, 1.24, 1.25 MHz
Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range, Units (dBm/Watts)
Sweep	Single/Continuous, Trigger Sweep
Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality Measurements

RF Measurements (Option 0042) (temperature range 15 ºC to 35 ºC)

RF Channel Power Accuracy	± 1.5 dB, ± 1.0 dB typical, (RF input –50 dBm to +20 dBm)

Demodulation (Option 0043) (temperature range 15 ºC to 35 ºC)

Frequency Error	± 10 Hz + time base error, 99% confidence level (in slow mode)
Rho Accuracy	± 0.005, for Rho > 0.9
Residual Rho	> 0.995, typical, > 0.99 maximum, (RF input –50 dBm to +20 dBm)
PN Offset	1 x 64 chips
Pilot Power Accuracy	± 1.0 dB typical, relative to channel power
Tau	± 0.5 µs typical, ± 1.0 µs maximum

Over-the-Air (OTA) Measurements (Option 0033)

Pilot Scanner	Nine strongest pilots
Multipath Scanner	Six multipaths' power relative to strongest pilot
Limit Test	Average of ten tests compared to limit

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Spectrum Master™ MS2712E and MS2713E Specifications

EV-DO Signal Analyzers (Option 0062, 0063, 0034)

Measurements

RF (Option 0062)	Demodulation (Option 0063)	Over-the-Air (OTA) (Option 0034)	Pass/Fail (User Editable)
Channel Spectrum Channel Power Occupied Bandwidth Peak-to-Average Power Power vs. Time Pilot & MAC Power Channel Power Frequency Error Idle Activity On/Off Ratio Spectral Emission Mask Multi-carrier ACPR RF Summary	MAC Code Domain Power Graph Pilot & MAC Power Channel Power Frequency Error Rho Pilot Rho Overall Data Modulation Noise Floor MAC Code Domain Power Table Code Status Power Code Utilization Data Code Domain Power Active Data Power Data Modulation Rho Pilot Rho Overall Maximum Data CDP Minimum Data CDP Modulation Summary	Pilot Scanner (Nine) PN E_c/I_o Tau Pilot Power Channel Power Pilot Dominance Multipath Scanner (Six) E_c/I_o Tau Channel Power Multipath Power	Channel Power Occupied Bandwidth Peak-to-Average Power Carrier Frequency Frequency Error Spectral Mask Noise Floor Pilot Power RMS Phase Error Tau Code Utilization Measured PN Pilot Dominance Multipath Power

Setup Parameters

PN Setup	PN Trigger (No Trigger, GPS, External), PN Search Type (Auto, Manual), PN Offset
Walsh Codes	64, 128
Measurement Speed	Fast, Normal, Slow
External Trigger Polarity	Rising, Falling
Slot Type	Auto, Active, Idle
Number of Carriers	1 to 5
Carrier Bandwidth	1.23, 1.24, 1.25 MHz
Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range, Units (dBm/Watts)
Sweep	Single/Continuous, Trigger Sweep
Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality Measurements

RF Measurements (Option 0062) (temperature range 15 ºC to 35 ºC)

RF Channel Power Accuracy	± 1.5 dB, ± 1.0 dB typical, (RF input –50 dBm to +20 dBm)

Demodulation (Option 0063) (temperature range 15 ºC to 35 ºC)

EV-DO Compatibility	Rev 0 and Rev A
Frequency Error	± 10 Hz + time base error, 99% confidence level
Rho Accuracy	± 0.01, for Rho > 0.9
Residual Rho	> 0.995 typical, > 0.99, maximum (RF input –50 dBm to +20 dBm)
PN Offset	Within 1 x 64 chips
Pilot Power Accuracy	± 1.0 dB typical, relative to channel power
Tau	± 0.5 µs typical, ±1.0 µs maximum

Over-the-Air (OTA) Measurements (Option 0034)

Pilot Scanner	Nine strongest pilots
Multipath Scanner	Six multipaths' power relative to strongest pilot

Spectrum Master™ MS2712E and MS2713E Specifications

Fixed WiMAX Signal Analyzers (Options 0046, 0047)

Measurements

RF (Option 0046)	Demodulation (Option 0047)	Over-the-Air (OTA)	Pass/Fail (User Editable)
Channel Spectrum Channel Power Occupied Bandwidth Power vs. Time Channel Power Preamble Power Data Burst Power Crest Factor ACPR RF Summary	Constellation RCE (RMS/Peak) EVM (RMS/Peak) Frequency Error Carrier Frequency Base Station ID Spectral Flatness Adjacent Subcarrier Flatness EVM vs. Subcarrier/Symbol RCE EVM Frequency Error Carrier Frequency Base Station ID Modulation Summary	There are no additional OTA Measurements. RF Measurements and Demodulation can be made OTA	Channel Power Occupied Bandwidth Burst Power Preamble Power Crest Factor Frequency Error Carrier Frequency EVM RCE Base Station ID

Setup Parameters

Bandwidth	1.25, 1.50, 2.50, 3.50, 5.00, 5.50, 6.00, 7.00, 10.00 MHz
Cyclic Prefix Ratio (CP)	1/4, 1/8, 1/16, 1/32
Span	5, 10, 15, 20 MHz
Frame Length	2.5, 5.0, 10.0 msec
Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range
Sweep	Single/Continuous, Trigger Sweep
Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality Measurements

RF Measurements (Option 0046) (temperature range 15 ºC to 35 ºC)

RF Channel Power Accuracy	± 1.5 dB, ± 1.0 dB typical, (RF input –50 dBm to +20 dBm)

Demodulation (Option 0047) (temperature range 15 ºC to 35 ºC)

Frequency Error	0.07 ppm + time base error, 99% confidence level
Residual EVM (rms)	3 % typical, 3.5 % maximum (RF Input –50 dBm to +20 dBm)

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Spectrum Master™ MS2712E and MS2713E Specifications

Mobile WiMAX* Signal Analyzers (Options 0066, 0067, 0037)

Measurements

RF (Option 0066)	Demodulation (Option 0067)	Over-the-Air (OTA) (Option 0037)	Pass/Fail (User Editable)
Channel Spectrum Channel Power Occupied Bandwidth Power vs. Time Channel Power Preamble Power Downlink Burst Power Uplink Burst Power ACPR RF Summary	Constellation RCE (RMS/Peak) EVM (RMS/Peak) Frequency Error CINR Base Station ID Sector ID Spectral Flatness Adjacent Subcarrier Flatness EVM vs. Subcarrier/Symbol RCE (RMS/Peak) EVM (RMS/Peak) Frequency Error CINR Base Station ID Sector ID DL-MAP (Tree View) Modulation Summary	Channel Power Monitor Preamble Scanner (Six) Preamble Relative Power Cell ID Sector ID PCINR Dominant Preamble Base Station ID	Channel Power Occupied Bandwidth Downlink Bust Power Uplink Burst Power Preamble Power Crest Factor Frequency Error Carrier Frequency EVM RCE Sector ID

Setup Parameters

Zone Type	PUSC
DL-MAP Auto Decoding	Convolutional Coding (CC), Convolutional Turbo Coding (CTC)
Bandwidths	3.50, 5.00, 7.00, 8.75, 10.00 MHz
Cyclic Prefix Ratio (CP)	1/8
Span	5, 10, 20, 30 MHz
Frame Lengths	5, 10 msec
Demodulation	Auto, Manual, FCH
Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range
Sweep	Single/Continuous, Trigger Sweep
Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality Measurements

RF Measurements (Option 0066) (temperature range 15 ºC to 35 ºC)

RF Channel Power Accuracy	± 1.5 dB, ± 1.0 dB typical, (RF input –50 dBm to +20 dBm)

Demodulation (Option 0067) (temperature range 15 ºC to 35 ºC)

Frequency Error	0.02 ppm + time base error, 99% confidence level
Residual EVM (rms)	2.5 % typical, 3.0 % maximum, (RF Input –50 dBm to +20 dBm)

Over-the-Air (OTA) Measurements (Option 0037)

Channel Power Monitor	Over time (one week), measurement time interval 1 to 60 sec
Preamble Scanner	Six Strongest Preambles
Auto Save	Yes
GPS Logging	Yes

* Conforms to IEEE Std. 802.16e-2005, WiMAX Forum® Air Interface - Mobile System Profile - Release 1.0 Certified, System Profiles according to WMF-T24-001-R010v07.

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Spectrum Master™ MS2712E and MS2713E Specifications

ISDB-T Measurements(Options 0030, 0079, 0032)

For full specifications refer to the Digital Broadcast Analysis Options Technical Data Sheet 11410-00624

Measurements

ISDB-T RF (Option 0030)	ISDB-T Signal Analysis (Option 0030)	ISDB-T BER Analysis (Option 0079)	ISDB-T SFN Analysis (Option 0032)
Signal Power Channel Power Termination Voltage Open Terminal Voltage Field Strength Spectrum Monitor Channel Power Zone Center Channel Zone Center Frequency Spectrum Mask Mask (Standard A) Japan Mask (Standard B) Japan Mask (Critical) Brazil Mask (Sub-critical) Brazil Mask (Non-critical) Brazil Phase Noise Spurious Emissions	Constellation (w/zoom) Layer A, B, C, TMCC Sub-carrier MER Delay Profile (w/zoom) Frequency Response Measured Data Frequency Frequency Offset MER (Total, Layer A/B/C, TMCC, AC1) Modulation (Layer A/B/C) Mode, GI Sub-carrier MER w/marker Delay w/marker Frequency Response w/marker	Layer A, Layer B, Layer C BER and Error Count per Layer Before RS Before Viterbi PER and Error Count per Layer MPEG Bit Rate per Layer TMCC Information per Layer Modulation Code Rate Interleave Segments Channel Power Mode, GI Signal Sync Status ASI Out	Impulse Response (w/zoom) In-band Spectrum Measured Data Channel Power Delay DU Ratio Power Field Strength

ISDB-T Measurement Modes
- Custom: User specified measurement and setup parameters
- Easy: User specified measurements. Some setup parameters are automatically set or detected
- Batch: User specified measurements and channels for automatic measurement, results' display and storage

Setup Parameters

Channel Map	UHF (Japan), UHF (Brazil), IF (37.15 MHz), None
Channel	13 to 62 (Japan), 14 to 69 (Brazil)
Frequency	35 MHz to 806 MHz
Bandwidths	6 MHz, 8 MHz
Partial Reception	Recognized when layer A segment count is 1
One-Seg	On: synchronizes with single segment transmission (Bandwidth 6 MHz only) Off: synchronizes with normal 13 segment signal
Pre-amp	On, Off
Reference Level Setting	–25 dBm to +20 dBm/5 dB steps (Preamp Off), –50 dBm to –10 dBm/10 dB steps (Preamp On)

ISDB-T Digital Video Measurements (Option 0030)

Channel Power Accuracy	± 2 dB, (RF input -84 dBm to -10 dBm)
Frequency Lock Range	± 90 kHz
Frequency Offset Accuracy	± (measurement frequency x reference frequency accuracy) ± 0.3 Hz
Residual MER	≥ 42 dB, typical (Preamp Off, Reference level: –20 dBm) ≥ 37 dB, typical (Preamp On, Reference level: –50 dBm)
Sub-carrier MER Display Range	± 2.785 MHz from center frequency (Bandwidth 6 MHz) ± 3.714 MHz from center frequency (Bandwidth 8 MHz)
Delay Profile Resolution	0.12 µs (Bandwidth 6 MHz) 0.09 µs (Bandwidth 8 MHz)
Frequency Response Resolution	1 kHz, 0.1 dB
Phase Noise Range	–40 dBc/Hz to –140 dBc/Hz
Spurious Emissions Search Range	5 MHz to 5x input signal frequency

ISDB-T BER Measurements (Option 0079)

BER Measurement Display per Layer	Rate and Error count: Before Viterbi, Before RS
PER Measurement Display per Layer	Rate and Error count
TMCC Information Display per Layer	Modulation, Code Rate, Interleave, Number of segments
ASI Output	BNC-J 75 Ω

ISDB-T SFN Measurements (Option 0032)

Delay Profile Display Range	–1008 µs to +1008 µs
Delay Wave Estimated Level Accuracy	± 2.5 dB typical (–10 dBm to –79 dBm)
DU Ratio Accuracy	± 1 dB typical (–10 dBm to –70 dBm)
Inband Spectrum Range	± 2.74 MHz (Mode 2), ± 2.76 MHz (Mode 3)

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Spectrum Master™ MS2712E and MS2713E Specifications

DVB-T/H (Options 0064, 0057, 0078)

For full specifications refer to the Digital Broadcast Analysis Options Technical Data Sheet 11410-00624

Measurements

DVB-T/H RF (Option 0064)	DVB-T/H Signal Analysis (Option 0064)	DVB-T/H BER Analysis (Option 0057)	DVB-T/H SFN Analysis (Option 0078)
Signal Power	Composite or Individual Views	BER	Impulse Response (w/zoom)
Channel Power	Constellation	Before RS	Inband Spectrum
Termination Voltage	Impulse Response (w/zoom)	Before Viterbi	Measured Data
Open Terminal Voltage	Carrier MER (w/zoom)	PER (Packet)	Channel Power
Field Strength	Freq Response	Channel Power	Delay
Spectrum Monitor	(composite view only)	MER (Quick)	DU Ratio
Channel Power	Measured Data	Bit Rate	Power
Zone Center Channel	Mode, GI	TPS Info	Field Strength
Zone Center Frequency	Modulation	Length Indicator	
Shoulder Attenuation	Hierarchy	Mode, GI	
Channel Power	Freq Offset	Modulation	
Zone Center Channel	Channel Power	Hierarchy	
Zone Center Frequency	MER (Total/Data/TPS)	Interleave Type	
Lower Shoulder Attenuation	TPS Warning Message	Cell ID	
Upper Shoulder Attenuation	TPS Info	Code Rate	
	Interleave Type	Time Slicing	
	Cell ID	MPE-FEC	
	Code Rate (HP/LP)	TPS Warning Message	
	Time Slicing (HP/LP)	ASI Out	
	MPE-FEC (HP/LP)		

Setup Parameters

Channel Map	UHF (Australia), UHF (Europe), VHF (Europe), None
Channel	28 to 69 (Australia), 21 to 69 (Europe), 5 to 12 (Europe)
Frequency Offset	± 166.666 kHz, ± 333.333 kHz, ± 499.999 kHz, None
Frequency	30 MHz to 990 MHz when Channel Map is None
Bandwidth	5, 6, 7, 8 MHz
Pre-amp	On, Off
Reference Level	–25 dBm to +20 dBm/5 dB steps (Preamp Off), –50 dBm to –10 dBm/10 dB steps (Preamp On)

DVB-T/H Digital Video Measurements (Option 0064)

Channel Power Accuracy	± 2 dB, (RF input –84 dBm to –10 dBm)
Frequency Lock Range	± 90 kHz
Frequency Offset Accuracy	± (measurement frequency x reference frequency accuracy) ± 0.3 Hz
Residual MER	≥ 42 dB (Preamp Off, Reference Level: –20 dBm) ≥ 37 dB (Preamp On, Reference Level: –50 dBm)
Impulse Response Resolution	0.11 µs (Bandwidth: 8 MHz), 0.1 dB
Carrier MER Marker	Carrier Number, Offset Frequency and MER
Composite View	Simultaneous display of Constellation (Data and TPS), Impulse Response, Carrier MER and Frequency Response

DVB-T/H BER Measurements (Option 0057)

Bit Count Setting	Range 1E+6 to 1E+12
Service Type	In Service: BER measurement of normal in-service data traffic Simultaneous BER measurement Before Viterbi and Before RS error correction Out of Service: BER measurement of a PRBS23 data sequence BER measurement point can be selected Before Viterbi, Before RS or After RS
TPS Information	Length indicator, Mode, GI, Modulation, Hierarchy, Inner Interleave, Cell ID, Code Rate,Time Slicing, MPE-FEC
ASI Output	BNC-J 75 Ω

DVB-T/H SFN Measurements (Option 0078)

Impulse Response Display Range	–896 µs to +896 µs (Bandwidth: 8 MHz)
Resolution	0.11 µs (33 m) (Bandwidth: 8 MHz)
Marker	Delay time, relative level (DU ratio), power and field strength or termination voltage
Inband Spectrum Range	± 3.804 MHz (Bandwidth: 8 MHz)

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Spectrum Master™ MS2712E and MS2713E Specifications

AM/FM/PM Signal Analyzers (Option 0509)

Measurements

	RF Spectrum AM/FM/PM	Audio Spectrum (AM)	Audio Spectrum (FM/PM)	Audio Waveform (AM)	Audio Waveform (FM/PM)	Summary (AM)	Summary (FM/PM)
Graphic Display	Power (dBm) vs. Frequency	Depth (%) vs. Modulation Frequency	Deviation (kHz/rad) vs. Modulation Frequency	Depth (%) vs. Time	Deviation (kHz/rad) vs. Time	None	None
Numerical Displays	Carrier Power Carrier Frequency Occupied Bandwidth	AM Rate RMS Depth (Pk-Pk)/2 Depth SINAD* THD* Distortion/Total Vrms*	FM/PM Rate RMS Deviation (Pk-Pk)/2 Deviation SINAD* THD* Distortion/Total Vrms*	AM Rate RMS Depth (Pk-Pk)/2 Depth SINAD* THD* Distortion/Total Vrms*	FM/PM Rate RMS Depth (Pk-Pk)/2 Depth SINAD* THD* Distortion/Total Vrms*	RMS Depth (AM) Peak + Depth Peak – Depth (Pk-Pk)/2 Depth Carrier Power Carrier Frequency Occupied Bandwidth AM Rate SINAD* THD* Distortion/Total Vrms*	RMS Deviation (FM/PM) Peak + Depth Peak – Depth (Pk-Pk)/2 Depth Carrier Power Carrier Frequency Occupied Bandwidth AM Rate SINAD* THD* Distortion/Total Vrms*

Setup Parameters

Frequency	Center Freq, Span, Freq Step, Signal Standard, Channel, Channel Increment, Set Carrier Freq
Amplitude	Scale, Power Offset, Adjust Range
Setup	Demod Type (AM, FM, PM), IFBW, Auto IFBW
Measurements	RF Spectrum AM/FM/PM, Audio Spectrum (AM/FM/PM), Audio Waveform (AM/FM/PM), Summary (AM/FM/PM), Average
Marker	On/Off, Delta, Peak Search, Marker Freq to Center, Marker to Ref Lvl, Marker Table, All Markers Off

Specifications

AM	Modulation Rate: ± 1 Hz (< 100 Hz), ± 2% (> 100 Hz) Depth: ± 5% for (Modulation rates 10 Hz to 100 kHz)
FM	Modulation Rate: ± 1 Hz (< 100 Hz); ± 2% (100 Hz to 100 kHz) Deviation Accuracy: ± 5% (100 Hz to 100 kHz)**
PM	Modulation Rate: ± 1 Hz (< 100 Hz); ± 2% (100 Hz to 100 kHz) Deviation Accuracy: ± 5% (deviation 0 to 93 Rad, rate 10 Hz to 5 kHz)**
IF bandwidth	1 kHz to 300 kHz in 1-3 sequence
Frequency Span	RF Spectrum: 10 kHz to 10 MHz Audio Spectrum: 2 kHz, 5 kHz, 10 kHz, 20 kHz
RBW/VBW	30
Span/RBW	100
Sweep time	50 µs to 50 ms (Audio Waveform)

* Requires Sinewave modulation

** IFBW must be greater than 95% occupied BW

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Spectrum Master™ MS2712E and MS2713E Specifications

General Specifications

All specifications and characteristics apply to rev 2 instruments under the following conditions, unless otherwise stated: 1) After 5 minutes of warm-up time, where the instrument is left in the ON state; 2) All specifications apply when using internal reference; 3) All specifications subject to change without notice; 4) Typical performance is the measured performance of an average unit and is not warranted; 5) Recommended calibration cycle is 12 months; 6) Performance Sweep Mode.

Setup Parameters	
System	Status (Temperature, Battery Info, Serial Number, Firmware Version, Options Installed)
	Self Test, Application Self Test
	GPS (see Option 0031)
System Options	Name, Date and Time, Brightness, Volume
	Language (English, French, German, Spanish, Chinese, Japanese, Korean, Italian, User defined)
	Reset (Factory Defaults, Master Reset, Update Firmware)
File	Save, Recall, Delete, Directory Management
Save/Recall	Setups, Measurements, Screen Shots Jpeg (save only)
Delete	Selected File, All Measurements, All Mode Files, All Content
Directory Management	Sort Method (Name/Type/Date), Ascend/Descend, Internal/USB, Copy, Format USB
Internal Trace/Setup Memory	2,000 traces, 2,000 Setups
External Trace/Setup Memory	Limited by size of USB Flash drive
Mode Switching	Auto-Stores/Recalls most recently used Setup Parameters in the Mode
Connectors	
RF Out	Type N, female, 50 Ω
RF Out Damage Level	23 dBm, ± 50 VDC
RF In	Type N, female, 50 Ω
RF In Damage Level	+35 dBm peak, ± 50 VDC, Maximum Continuous Input (≥ 10 dB attenuation)
GPS	SMA(f)
External Power	5.5 mm barrel connector, 11.0 to 14.5 VDC, < 4.0 Amps
USB Interface (2)	Type A, Connect USB Flash Drive and Power Sensor
USB Interface	5-pin mini-B, Connect to PC for data transfer
Ethernet Interface	RJ45 connector for Ethernet 10-Base T (Available with option 0411 Ethernet)
Headset Jack	3.5 mm mini-phone plug
External Reference In	BNC, female, 50 Ω, Maximum Input +10 dBm 1 MHz, 5 MHz, 10 MHz, 13 MHz
External Trigger/Clock Recovery	BNC, female, 50 Ω, Maximum Input ± 50 VDC
Display	
Type	Resistive Touchscreen
Size	8.4" daylight viewable color LCD
Resolution	800 x 600
Battery	
Type	Li-Ion
Battery Operation	3.0 hours, typical
Electromagnetic Compatibility	
European Union	CE Mark, EMC Directive 2004/108/EC
	Low Voltage Directive 2006/95/EC
Australia and New Zealand	C-tick N274
Interference	EN 61326-1
Emissions	EN 55011
Immunity	EN 61000-4-2/-4-3/-4-4/-4-5/-4-6/-4-11
Safety	
Safety Class	EN 61010-1 Class 1
Product Safety	IEC 60950-1 when used with Company supplied Power Supply
Environmental	
Operating Temperature	–10 ºC to 55 ºC
Maximum Humidity	95% RH (non-condensing) at 40 °C
Shock	MIL-PRF-28800F Class 2
Storage	–40 ºC to 71 ºC
Altitude	4600 meters, operating and non-operating
ESD	
RF Port Center Pin	Withstands up to ± 15 kV
Size and Weight	
Size	273 mm x 199 mm x 91 mm (10.7 in x 7.8 in x 3.6 in)
Weight	3.45 kg, (7.6 lbs)

Spectrum Master™ MS2712E and MS2713E Specifications

Line Sweep Tools (for your PC)

Trace Capture		
	Browse to Instrument	View and copy traces from the test equipment to your PC using Windows Explorer
	Open legacy files	Open DAT files captured with Hand Held Software Tools v6.61
	Open Current files	Open VNA or DAT files
	Capture plots to:	The Line Sweep Tools screen, DAT files, Database, or JPEG
Traces		
	Trace Types	Return Loss, VSWR, DTF-RL, DTF-VSWR, Cable Loss, Smith Chart, and PIM
	Trace formats	DAT, VNA, CSV, PNG, BMP, JPG, HTML, Data Base, and PDF
Report Generation		
	Report Generator	Includes GPS location along with measurements
	Report Format	Create reports in HTML or PDF format
	Report setup	Report Title, Company, Prepared for, Location, Date and Time, Filename, Company logo
	Trace Setup	1 trace Portrait Mode, 2 Trace Portrait Mode, 1 Trace Landscape Mode
Trace Validation		
	Presets	7 presets allow "one click" setting of up to 6 markers and one limit line
	Marker Controls	6 regular Markers, Marker Peak, Marker valley, Marker between, and frequency entry
	Delta Markers	6 Delta markers
	Limit Line	Enable and drag or value entry. Also works with presets
	Next Trace Button	Next Trace and Previous trace arrow keys allow quick switching between traces
Tools		
	Cable Editor	Allows creation of custom cable parameters
	Distance to Fault	Converts a Return Loss trace to a Distance to Fault trace
	Measurement Calculator	Converts Real, Imaginary, Magnitude, Phase, RL, VSWR, Rho, and Transmit power
	Signal Standard Editor	Creates new band and channel tables
	Renaming Grid	36 user definable phrases for creation of file names, trace titles, and trace subtitles
Connectivity		
	Connections	Ethernet, USB cable, USB Memory Stick

Master Software Tools (for your PC)

Mapping (GPS Required)		
	Spectrum Analyzer Mode	MapInfo, MapPoint
	Mobile WiMAX OTA, LTE OTA Options	Google Earth, Google Maps, MapInfo
Folder Spectrogram (Spectrum Monitoring for Interference Analysis and Spectrum Clearing)		
	Folder Spectrogram – 2D View	Creates a composite file of multiple traces Peak Power, Total Power, Peak Frequency, Histogram, Average Power (Max/Min) File Filter (Violations over limit lines or deviations from averages) Playback
	Video Folder Spectrogram – 2D View	Create AVI file to export for management review/reports
	Folder Spectrogram – 3D View	Views (Set Threshold, Markers) - 3D (Rotate X, Y, Z Axis, Level Scale, Signal ID) - Playback (Frequency and/or Time Domain)
List/Parameter Editors		
	Traces	Add, delete, and modify limit lines and markers
	Product Updates	Auto-checks Anritsu website for latest revision firmware
	Firmware Upload	Upload new firmware into the instrument
	Pass/Fail	Create, download, or edit Signal Analysis Pass/Fail Limits
	Languages	Add up to two languages or modify non-English language menus
Script Master™		
	Channel Scanner Mode	Automate scan up to 1200 channels, repeat for sets of 20 channels, repeat all channels
	GSM/GPRS/EDGE or W-CDMA/HSPA+ Mode	Automate Signal Analysis testing requirements with annotated how-to pictures
Connectivity		
	Connections	Connect to PC using USB, Ethernet
	Firmware Updates	Product Update: download latest firmware version

Spectrum Master™ MS2712E and MS2713E Specifications

Ordering Information – Options

	MS2712E	MS2713E	Description
	9 kHz to 4 GHz	9 kHz to 6 GHz	Spectrum Analyzer
	Options	**Options**	
	MS2712E-0010	MS2713E-0010	Bias-Tee
	MS2712E-0009	MS2713E-0009	20 MHz Bandwidth Demod
	MS2712E-0031	MS2713E-0031	GPS Receiver (requires Antenna)
	MS2712E-0019	MS2713E-0019	High-Accuracy Power Meter (requires External Power Sensor)
	MS2712E-0029	MS2713E-0029	Power Meter
	MS2712E-0025	MS2713E-0025	Interference Analyzer (Option 0031 recommended)
	MS2712E-0027	MS2713E-0027	Channel Scanner
	MS2712E-0431	MS2713E-0431	Coverage Mapping (requires Option 0031)
	MS2712E-0090	MS2713E-0090	Gated Sweep
	MS2712E-0020	MS2713E-0020	Tracking Generator
	MS2712E-0509	MS2713E-0509	AM/FM/PM Analyzer
	MS2712E-0040	MS2713E-0040	GSM/EDGE RF Measurements*
	MS2712E-0041	MS2713E-0041	GSM/EDGE Demodulation*
	MS2712E-0044	MS2713E-0044	W-CDMA/HSPA+ RF Measurements*
	MS2712E-0065	MS2713E-0065	W-CDMA/HSPA+ Demodulation*
	MS2712E-0035	MS2713E-0035	W-CDMA/HSPA+ OTA Measurements*
	MS2712E-0541	MS2713E-0541	LTE RF Measurements*
	MS2712E-0542	MS2713E-0542	LTE Modulation Quality*
	MS2712E-0546	MS2713E-0546	LTE OTA Measurements* (recommend Option 0031)
	MS2712E-0551	MS2713E-0551	TD-LTE RF Measurements*
	MS2712E-0552	MS2713E-0552	TD-LTE Modulation Quality*
	MS2712E-0556	MS2713E-0556	TD-LTE OTA Measurements* (recommend Option 0031)
	MS2712E-0060	MS2713E-0060	TD-SCDMA/HSPA+ Measurements*
	MS2712E-0061	MS2713E-0061	TD-SCDMA/HSPA+ Demodulation*
	MS2712E-0038	MS2713E-0038	TD-SCDMA/HSPA+ OTA Measurements* (recommend Option 0031)
	MS2712E-0042	MS2713E-0042	CDMA RF Measurements*
	MS2712E-0043	MS2713E-0043	CDMA Demodulation*
	MS2712E-0033	MS2713E-0033	CDMA OTA Measurements**
	MS2712E-0062	MS2713E-0062	EV-DO RF Measurements*
	MS2712E-0063	MS2713E-0063	EV-DO Demodulation*
	MS2712E-0034	MS2713E-0034	EV-DO OTA Measurements**
	MS2712E-0046	MS2713E-0046	Fixed WiMAX RF Measurements*
	MS2712E-0047	MS2713E-0047	Fixed WiMAX Demodulation*
	MS2712E-0066	MS2713E-0066	Mobile WiMAX RF Measurements*
	MS2712E-0067	MS2713E-0067	Mobile WiMAX Demodulation*
	MS2712E-0037	MS2713E-0037	Mobile WiMAX OTA Measurements* (recommend Option 0031)
	MS2712E-0030	MS2713E-0030	ISDB-T Digital Video Measurements*
	MS2712E-0032	MS2713E-0032	ISDB-T SFN Measurements*
	MS2712E-0079	MS2713E-0079	ISDB-T BER Measurements (Requires option 0030, cannot be ordered with option 0411)
	MS2712E-0064	MS2713E-0064	DVB-T/H Digital Video Measurements*
	MS2712E-0078	MS2713E-0078	DVB-T/H SFN Measurements*
	MS2712E-0057	MS2713E-0057	DVB-T/H BER Measurements (Requires option 0064, cannot be ordered with option 0411)
	MS2712E-0411	MS2713E-0411	Ethernet Connectivity
	MS2712E-0098	MS2713E-0098	Standard Calibration (ANSI 2540-1-1994)
	MS2712E-0099	MS2713E-0099	Premium Calibration to Z540 plus test data

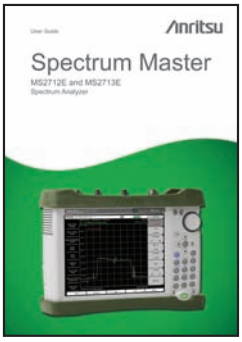
*Requires Option 0009, **Requires Option 0009 and Option 0031

Spectrum Master™ MS2712E and MS2713E Specifications

Power Sensors (For complete ordering information see the respective datasheets of each sensor)

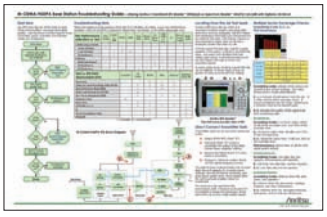
Model Number	Description
PSN50	High Accuracy RF Power Sensor, 50 MHz to 6 GHz, +20 dBm
MA24106A	High Accuracy RF Power Sensor, 50 MHz to 6 GHz, +23 dBm
MA24104A	Inline High Power Sensor, 600 MHz to 4 GHz, +51.76 dBm
MA24105A	Inline High/Peak Power Sensor, 350 MHz to 4 GHz, +3 dBm to +51.76 dBm
MA24108A	Microwave USB Power Sensor, 10 MHz to 8 GHz, +20 dBm
MA24118A	Microwave USB Power Sensor, 10 MHz to 18 GHz, +20 dBm
MA24126A	Microwave USB Power Sensor, 10 MHz to 26 GHz, +20 dBm

Manuals (soft copy included on Handheld Instruments Documentation Disc and at www.anritsu.com)



Part Number	Description
10920-00060	Handheld Instruments Documentation Disc
10580-00251	Spectrum Master User Guide (Hard copy included)
10580-00244	Spectrum Analyzer Measurement Guide - Interference Analyzer, Channel Scanner, Gated Sweep, AM/FM/PM Analyzer, Interference Mapping, Coverage Mapping
10580-00234	3GPP Signal Analyzer Measurement Guide - GSM/EDGE, W-CDMA/HSDPA, TD-SCDMA/HSDPA, LTE
10580-00235	3GPP2 Signal Analyzer Measurement Guide - CDMA, EV-DO
10580-00236	WiMAX Signal Analyzer Measurement Guide - Fixed WiMAX, Mobile WiMAX
10580-00237	Digital TV Measurement Guide - DVB-T/H, ISDB-T
10580-00240	Power Meter Measurement Guide - High Accuracy Power Meter
10580-00256	Programming Manual
10580-00280	PIM Master User Guide

Troubleshooting Guides (soft copy at www.anritsu.com)



Part Number	Description
11410-00551	Spectrum Analyzers
11410-00472	Interference
11410-00466	GSM/GPRS/EDGE Base Stations
11410-00566	LTE eNode Testing
11410-00463	W-CDMA/HSDPA Base Stations
11410-00465	TD-SCDMA/HSDPA Base Stations
11410-00467	cdmaOne/CDMA2000 1X Base Stations
11410-00468	CDMA2000 1xEV-DO Base Stations
11410-00470	Fixed WiMAX Base Stations
11410-00469	Mobile WiMAX Base Stations

Standard Accessories (included with instrument)

Part Number	Description
10920-00060	Handheld Instruments Documentation Disc
10580-00251	Spectrum Master User Guide (includes Bias-Tee, GPS Receiver)
2000-1654-R	Soft Carrying Case
2300-498	Master Software Tools (MST) CD Disc
2300-530	Anritsu Tool Box with Line Sweep Tools (LST) DVD Disc (For PIM Analyzer Trace Management)
2300-532	Map Master CD
633-44	Rechargeable Li-Ion Battery
40-168-R	AC-DC Adapter
806-141-R	Automotive Cigarette Lighter Adapter
3-2000-1498	USB A/5-pin mini-B Cable, 10 feet/305 cm
11410-00511	Spectrum Master MS2712E, MS2713E Technical Data Sheet One Year Warranty (Including battery, firmware, and software) Certificate of Calibration and Conformance

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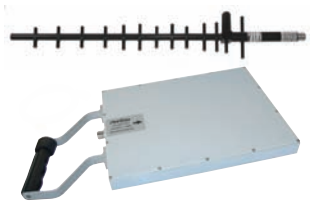
Spectrum Master™ MS2712E and MS2713E Specifications

Optional Accessories

Directional Antennas



Part Number	Description
2000-1411-R	822 MHz to 900 MHz, N(f), 10 dBd, Yagi
2000-1412-R	885 MHz to 975 MHz, N(f), 10 dBd, Yagi
2000-1413-R	1710 MHz to 1880 MHz, N(f), 10 dBd. Yagi
2000-1414-R	1850 MHz to 1990 MHz, N(f), 9.3 dBd, Yagi
2000-1415-R	2400 MHz to 2500 MHz, N(f), 10 dBd, Yagi
2000-1416-R	1920 MHz to 2170 MHz, N(f), 10 dBd, Yagi
2000-1519-R	500 MHz to 3 GHz, log periodic
2000-1677-R	300 MHz to 3 GHz, SMA(m), log periodic
2000-1659-R	698 MHz to 787 MHz, N(f), 8 dBd, Yagi
2000-1660-R	1425 MHz to 1535 MHz, N(f), 12 dBd, Yagi

Portable Antennas

Part Number	Description
2000-1200-R	806 MHz to 866 MHz, SMA(m), 50 Ω
2000-1473-R	870 MHz to 960 MHz, SMA(m), 50 Ω
2000-1035-R	896 MHz to 941 MHz, SMA(m), 50 Ω (1/2 wave)
2000-1030-R	1710 MHz to 1880 MHz, SMA(m), 50 Ω (1/2 wave)
2000-1474-R	1710 MHz to 1880 MHz with knuckle elbow (1/2 wave)
2000-1031-R	1850 MHz to 1990 MHz, SMA(m), 50 Ω (1/2 wave)
2000-1475-R	1920 MHz to 1980 MHz and 2110 MHz to 2170 MHz, SMA(m), 50 Ω
2000-1032-R	2400 MHz to 2500 MHz, SMA(m), 50 Ω (1/2 wave)
2000-1361-R	2400 MHz to 2500 MHz, 5000 MHz to 6000 MHz, SMA(m), 50 Ω
2000-1659-R	698 MHz to 787 MHz, N(f), 8 dBd, Yagi
2000-1660-R	1425 MHz to 1535 MHz, N(f), 12 dBd, Yagi
2000-1636-R	Antenna Kit (Consists of: 2000-1030-R, 2000-1031-R, 2000-1032-R, 2000-1200-R, 2000-1035-R, 2000-1361-R, and carrying pouch)

Mag Mount Broadband Antenna

Part Number	Description
2000-1647-R	Cable 1: 698 MHz to 1200 MHz 2 dBi peak gain, 1700 MHz to 2700 MHz 5 dBi peak gain, N(m), 50 Ω, 10 ft Cable 2: 3000 MHz to 6000 MHz 5 dBi peak gain, N(m), 50 Ω, 10 ft Cable 3: GPS 26 dB gain, SMA(m), 50 Ω, 10 ft
2000-1645-R	694 MHz to 894 MHz 3 dBi peak gain, 1700 MHz to 2700 MHz 3dBi peak gain, N(m), 50 Ω, 10 ft
2000-1646-R	750 MHz to 1250 MHz 3 dBi peak gain, 1650 MHz to 2000 MHz 5 dBi peak gain, 2100 MHz to 2700 MHz 3 dBi peak gain, N(m), 50 Ω, 10 ft
2000-1648-R	1700 MHz to 6000 MHz 3 dBi peak gain,N(m), 50 Ω, 10 ft

Filters

Part Number	Description
1030-114-R	806 MHz to 869 MHz, N(m) to SMA(f), 50 Ω
1030-109-R	824 MHz to 849 MHz, N(m) to SMA(f), 50 Ω
1030-110-R	880 MHz to 915 MHz, N(m) to SMA(f), 50 Ω
1030-105-R	890 MHz to 915 MHz, N(m) to N(f),50 Ω
1030-111-R	1850 MHz to 1910 MHz, N(m) to SMA(f), 50 Ω
1030-106-R	1710 MHz to 1790 MHz N(m) to N(f), 50 Ω
1030-107-R	1910 MHz to 1990 MHz, N(m) to N(f), 50 Ω
1030-112-R	2400 MHz to 2484 MHz, N(m) to SMA(f), 50 Ω
1030-149-R	High Pass, 150 MHz, N(m) to N(f), 50 Ω
1030-150-R	High Pass, 400 MHz, N(m) to N(f), 50 Ω
1030-151-R	High Pass, 700 MHz, N(m) to N(f), 50 Ω
1030-152-R	Low Pass, 200 MHz, N(m) to N(f), 50 Ω
1030-153-R	Low Pass, 550 MHz, N(m) to N(f), 50 Ω
1030-155-R	2500 MHz to 2700 MHz, N(m) to N(f), 50 Ω
1030-178-R	1920 MHz to 1980 MHz, N(m) to N(f), 50 Ω
1030-179-R	777 MHz to 787 MHz, N(m) to N(f), 50 Ω
1030-180-R	2500 MHz to 2570 MHz, N(m) to N(f), 50 Ω
2000-1684-R	791 MHz to 821 MHz, N(m) to N(f), 50 Ω

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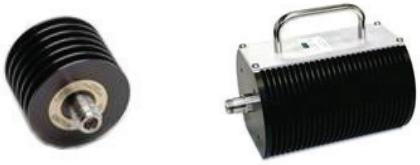
Optional Accessories (continued)

Attenuators



Part Number	Description
3-1010-122	20 dB, 5 W, DC to 12.4 GHz, N(m) to N(f)
42N50-20	20 dB, 5 W, DC to 18 GHz, N(m) to N(f)
42N50A-30	30 dB, 50 W, DC to 18 GHz, N(m) to N(f)
3-1010-123	30 dB, 50 W, DC to 8.5 GHz, N(m) to N(f)
1010-127-R	30 dB, 150 W, DC to 3 GHz, N(m) to N(f)
3-1010-124	40 dB, 100 W, DC to 8.5 GHz, N(m) to N(f), Uni-directional
1010-121	40 dB, 100 W, DC to 18 GHz, N(m) to N(f), Uni-directional
1010-128-R	40 dB, 150 W, DC to 3 GHz, N(m) to N(f)

Phase-Stable Test Port Cables, Armored w/ Reinforced Grip (recommended for cable & antenna line sweep applications)

Part Number	Description
15RNFN50-1.5-R	1.5 m, DC to 6 GHz, N(m) to N(f), 50 Ω
15RDFN50-1.5-R	1.5 m, DC to 6 GHz, N(m) to 7/16 DIN(f), 50 Ω
15RDN50-1.5-R	1.5 m, DC to 6 GHz, N(m) to 7/16 DIN(m), 50 Ω
15RNFN50-3.0-R	3.0 m, DC to 6 GHz, N(m) to N(f), 50 Ω
15RDFN50-3.0-R	3.0 m, DC to 6 GHz, N(m) to 7/16 DIN(f), 50 Ω
15RDN50-3.0-R	3.0 m, DC to 6 GHz, N(m) to 7/16 DIN(m), 50 Ω

Phase-Stable Test Port Cables, Armored (recommended for use with tightly spaced connectors and other general purpose applications)

Part Number	Description
15NNF50-1.5C	1.5 m, DC to 6 GHz, N(m) to N(f), 50 Ω
15NN50-1.5C	1.5 m, DC to 6 GHz, N(m) to N(m), 50 Ω
15NDF50-1.5C	1.5 m, DC to 6 GHz, N(m) to 7/16 DIN(f), 50 Ω
15ND50-1.5C	1.5 m, DC to 6 GHz, N(m) to 7/16 DIN(m), 50 Ω
15NNF50-3.0C	3.0 m, DC to 6 GHz, N(m) to N(f), 50 Ω
15NN50-3.0C	3.0 m, DC to 6 GHz, N(m) to N(m), 50 Ω
15NNF50-5.0C	5.0 m, DC to 6 GHz, N(m) to N(f), 50 Ω
15NN50-5.0C	5.0 m, DC to 6 GHz, N(m) to N(m), 50 Ω

Adapters

Part Number	Description
1091-26-R	SMA(m) to N(m), DC to 18 GHz, 50 Ω
1091-27-R	SMA(f) to N(m), DC to 18 GHz, 50 Ω
1091-80-R	SMA(m) to N(f), DC to 18 GHz, 50 Ω
1091-81-R	SMA(f) to N(f), DC to 18 GHz, 50 Ω
1091-172-R	BNC(f) to N(m), DC to 1.3 GHz, 50 Ω
510-102-R	N(m) to N(m), DC to 11 GHz, 50 Ω, 90 degrees right angle

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Spectrum Master™ MS2712E and MS2713E Specifications

Optional Accessories (continued)

Precision Adapters

Part Number	Description
34NN50A	Precision Adapter, N(m) to N(m), DC to 18 GHz, 50 Ω
34NFNF50	Precision Adapter, N(f) to N(f), DC to 18 GHz, 50 Ω

Backpack and Transit Case

Part Number	Description
67135	Anritsu Backpack (For Handheld Instrument and PC)
760-243-R	Large Transit Case with Wheels and Handle

Miscellaneous Accessories

Part Number	Description
2000-1528-R	GPS Antenna, SMA(m) with 15 ft cable
2000-1652-R	GPS Antenna, SMA(m) with 1 ft cable
806-245-R	Calibration Accessory for use with Option 20 Tracking Generator
2000-1374	External Charger for Li-Ion Batteries
2000-1371-R	Ethernet Cable, 7 ft/213 cm
2000-1689	EMI Near Field Probe Kit
3-806-152	Cat 5e Crossover Patch Cable, 7 ft/213 cm)
2300-517	Phase Noise Measurement Software (requires Ethernet Option 0411)
633-75	8000 mAh High-capacity Battery Pack
2000-1653	Anti-glare Screen Cover (package of 2)

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11410-00511, Rev. L Printed in United States 2012-04
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